Telephone Engineer

Published Monthly by TELEPHONE ENGINEER PUBLISHING COMPANY, 185 North Wabash Avenue

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SUBSCRIPTIONS:—The subscription price of TELEPHONE ENGINEER is $2.00 a year in the United States, Cuba and Mexico; in Canada it is $3; in all other countries $4. Single copies, U. S. A., 20 cents.

Entered as second-class matter, June 6, 1922, at the post office at Chicago, Ill., under the act of March 3, 1879

Volume 35 DECEMBER, 1931 No. 12

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The Modern Telephone Man Speaking of the trend toward so-called modernism, even the modern telephone man "ain't what he used to be." And that goes for the Independent telephone man who owns a single telephone exchange as well as the men who head large telephone companies with any number of large and small exchanges. If we wanted to spout platitudes we might say smugly that it's all been for the best, —meaning, of course, that the current business upheavals perhaps in the long run will prove beneficial for the telephone industry—that is, if we can keep our heads above the water until we reach a safe landing?

Why? Because a wave of economy is sweeping the industry. We don't mean economy in the sense you may think we do. We don't mean elimination of expenditures which would be fatal to the advancement of the industry. What we do mean is a curtailment of unnecessary expenditures and a careful selection of the equipment which is purchased.

A short time back those engaged in the telephone business were smitten with the belief that they couldn't lose. No matter which way they turned they made money. (This is true whether or not they will admit it.) It was a lucrative business. Speculators bought up telephone plants in a hurry,

believing it was the simplest way to make easy money. Some of these speculators, although they knew little or nothing of the telephone business, did make money, but not out of earnings. Some of them "got out" of the business in time, while others were "stuck," wondering how and why they had been led to believe that it was a "snap" to make money in the telephone industry.

Even legitimate telephone men had begun to feel pretty well pleased with themselves because of the nice fat profits they were rolling up. The result was inevitable; carelessness and extravagance in their purchases. They bought often and hurriedly, without due regard for values. They invested in experimental devices placed on the market, without weighing the actual usefulness of such equipment before making purchases.

Now, during the process of business reorganization, such faulty business practices are being remedied. Telephone men realize that it is possible to make mistakes and are moving a little more slowly, a little more carefully and, as we have said, it is a good thing for the industry.

It was with satisfaction that we noted in a recent survey made by a representative of TELEPHONE ENGINEER, that telephone men, as intelligent as ever, and a little more sane now than they were a few years ago, have not permitted the pendulum to swing too far in the opposite direction. They have not undertaken a rigid sort of economy, cutting down expenses to a point which would bring the industry to a complete standstill.

Telephone men all the way across the country from Texas in the southwest to Maine in the northeast, were interviewed by this TELEPHONE ENGINEER representative who made an overland automobile trip for this express purpose. He found that construction and purchases at the present time are below normal. He also found that in many instances exhaustive studies are being made by telephone men such as have hitherto been unheard of, to determine methods of effecting economies and maintenance and management of plants, without in any way sacrificing the quality of service. He also found that telephone men believe that in making future purchases they can improve the quality of service and at the same time reduce maintenance.

This was most gratifying. It shows that the telephone man is living up to the ideal of progress the world has come to expect. It is to be hoped that if there are any telephone men who believe that an inactive policy is an economical one, that they will soon see the error of their ways. It is obvious that under such conditions the speculator will gladly give way to the legitimate telephone man.

Telephone men who have conducted surveys and gathered data and statistics regarding telephone maintenance, are right. Economies can be effected, by making purchases carefully. Every product should be given due consideration as to its adaptability to the needs of the individual plant. The time and perhaps expense involved in making such comparisons will be well justified, and at the same time the industry will be permitted to continue its advancement, while the individual concerns will discover untold numbers of small savings, which in the long run will result in a noticeably economic, yet progressive program.

Rates Should Be Raised

Scarcely a newspaper is printed anywhere in the country today, without some mention of a rate controversy. State commissions are loaded down with utility hearings from cities, towns, villages and hamlets. Everywhere, everyone seems to believe that because business is poor, rates should be lowered.

They reach this unanimous conclusion by reasoning that the price of raw products is down, therefore the cost of construction and maintenance is lower, and rates should be reduced.

However, these logical thinkers have overlooked a few points. In fact, it is our belief that it is such thinking as this that is prolonging this turbulent period of reconstruction.

For instance, these "thinkers" have failed to notice the promotional expense to which telephone companies everywhere have gone to keep old subscribers, and to enroll new ones to compensate for those who have dropped out. Perhaps the public thinks "that is the telephone company's business." It is the telephone company's business.

However, in order to advance and give complete, up-to-date service, the telephone company must have sufficient patrons in order to meet operating expenses, else the company could not continue without raising rates; yet the cost of this "telephone advertising" necessarily absorbs some of the proceeds of the company which otherwise might go into improvements, or if not needed there, be returned to the subscribers in the form of reduced rates.

No telephone company that wishes to keep its subscribers' list up to the maximum, has dared to fall down on its service. On the contrary, in many quarters, additional service has been offered as an inducement to new subscribers. Because of the necessity for good service, a great many telephone companies have substituted metallic lines for part or all of their ground return lines without any effort to raise the rates, although such increase is allowed by state commissions everywhere because of the added cost involved in the installation and maintenance of metallic lines.

The general public, so desirous of lower rates, does not seem to appreciate the fact that although

Our Engineering and Management Course

Advantages of Common Battery System Which Makes Possible Automatic Supervision and Signalling, Told Here in Eighth Installment of a Course of Telephone Instruction Prepared by B. C. Burden, Transmission Engineer, Lincoln Telephone and Telegraph Co.

General

In magneto offices the current for signalling and talking purposes is supplied from a local hand generator and from two or three dry cells. In common battery offices the signalling and talking current is furnished by a large storage battery which is common to all subscribers' lines hence the name "common battery."

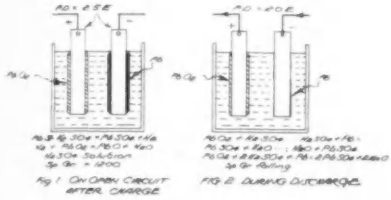

Fig. 1. On Open Circuit After Charge. Fig. 2. During Discharge.

This method of supplying electrical energy for talking purposes is much more economical than where a set of batteries is required at every station. The principal advantage of the common battery, however, is the automatic supervision and signalling made possible by the use of a central office battery common to all subscribers' lines.

Another outstanding advantage of common battery plant is the more uniform grade of transmission which is inherent to common battery operation as compared to a magneto plant where battery current is supplied locally with individual batteries at each subscriber's station. It is obvious that the drop in voltage of magneto subscribers' dry cells over a period of several months will not be uniform, and will depend upon the amount of use that is made of each particular telephone. Therefore, if a definite periodic battery replacement program is followed, batteries will be replaced before they have reached the end of their useful life whereas others will require replacing probably before the time of making these periodic replacements, with the result that the transmission at such stations will suffer until such time as the replacement is made. But with common battery plant the total battery voltage is never allowed to fall below a fixed limit hence uniform transmission is supplied at all times.

This section of the Engineering and Management course discusses the theory and general features of the central office common battery.

Theory of Lead Acid Storage Cells

There are in use in this country two principal types of storage cells, one is the lead acid type and the other is the alkaline cell. The lead acid type cell is almost universally used for telephone central office batteries. Lead acid storage cells consist of a group of positive plates of lead peroxide Pbo_2 (brown in color) and negative plates of sponge lead Pb (grey

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a rate reduction means a loss of many thousands of dollars to the telephone company, it amounts to only a few cents a month, or a few dollars a year, saved by the individual subscriber.

No, they do not think of these things. To do them credit, they perhaps do not know tbout them. Their one fear is that since prices are supposed to be down, the telephone company, unless it lowers its rates, will make too large a profit. Yet the telephone company is only allowed a certain profit by the state commission, and this fact is probably better known by telephone executives than by telephone subscribers. Telephone men who are in the field to stay will not try to exceed the profit allowed them by the state, knowing full well that should they do so, it will eventually cause them to lose the prestige and respect so necessary to the continued success of their business.

By demanding lower rates at this time, subscribers are merely demanding that telephone companies curtail expenditure without regard to how it may be accomplished. This would mean less construction and a minimum spent on maintenance. It would mean fewer telephone men at work. It would mean the purchase of less equipment, which would curtail manufacturing and consequently reduce the number of factory workers; this in turn would result in less demand for raw materials and fewer laborers at work. The telephone industry is the largest in the world, and is an integral part of every other business of any importance. If all the rate cases now being heard would result in favor of the subscribers, the damage to the telephone industry and through it to the other business institutions of the world in their present critical state, would be inestimable.

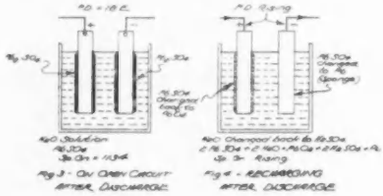
Only in a very few instances should rates be lowered. On the contrary, state commissions should see that telephone rates in many cases are raised, not especially for the benefit of the telephone companies, but for the benefit of the business world. If telephone rates were raised, telephone companies would be required to spend their surplus in construction and improvements, in order not to exceed their legitimate profits, and the improvements to be had today are many; never have so many former innovations pertinent to the telephone industry been perfected and new ones invented, as during the last few years.

If telephone rates generally were raised, rather than lowered, the opposite of the deterioration outlined above would take place. Mining, manufacturing, selling, building, advertising—all would benefit greatly from such a step, and the cost to each individual telephone subscriber would only be a few additional cents per month. It would mean many more men at work and prosperity in the telephone and allied industries would spread into other fields.

In fact, the raising of telephone rates would exert a tremendous influence in speeding the return of prosperity to industry in general.

in color). These plates are emersed in a solution of sulphuric acid and water H_2SO_4 plus H_2O called electrolyte. Such a cell will under normal conditions give a voltage of 2 volts and has a very low internal resistance. The theory of operation of this type cell is as follows:

Referring to Fig. 1, a lead acid cell is shown on open circuit immediately after being charged. The chemical condition of electrolyte and cell elements is shown by the chemical equation. It will be noticed that the cell voltage is 2.5 volts immediately after charge. Also that the specific gravity is 1.210 and that the negative plate is pure sponge lead and the positive plate lead peroxide and that the electrolyte is a fairly strong solution of sulphuric



acid having a gravity of 1.210. Fig. 2 shows what happens during the discharge of a lead acid cell. It will be noted that as soon as current is drawn from the cell the potential difference between the two elements drops to 2 volts. The electrical current which flows in the external circuit is produced by the H_2SO_4 acid combining with the lead Pb (sponge lead) and the lead peroxide Pbo_2 forming lead sulphate $PbSO_4$. As the discharge continues the specific gravity of the electrolyte falls until a point is reached at which the discharge should be stopped. The lead sulphate formed on the positive and negative plates is in finally divided form and no apparent change takes place on the plate except a slight change in color. The result of the discharge cycle is shown in Fig. 3. It will be noted that the negative and positive plates have both been converted to lead sulphate and that the electrolyte H_2SO_4 has been converted to H_2O (water) and that the voltage has been gradually lowered and is about 1.75 or 1.8 at the point where the cell is completely discharged.

Such a cell is charged or restored to its initial condition by passing direct current through the battery in opposite directions to the discharging current which results as shown in Fig. 4. It will be noted that the lead sulphate $PbSO_4$ on both positive and negative plates is changed back to lead peroxide and sponge lead respectively and at the same time the SO_4 portion back to sulphuric acid H_2SO_4. The net result of the charging cycle is to reconvert the lead sulphate to sponge lead Pb on the negative plate and lead peroxide PbO_2 on the positive plate and to change the electrolyte back from a weak acid or almost water solution to a solution with a high acid content and at the same time to raise the cell voltage. This is shown by the following chemical equation which expresses the combined reaction on both positive and negative plates

$$PbO_2 + Pb + \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftarrows}} 2H_2SO_4 = 2PbSO_4 + 2H_2O$$

It will be noted by the above explanation that both the cell voltage and gravity fall as the cell is discharged and rise as it is charged, and from this it would seem that the state of charge of batteries might be determined by either voltage of gravity. Generally speaking voltage readings cannot be relied upon to determine the exact state of charge of a storage battery and gravity readings are used to indicate the condition of the charge of a storage battery.

DOMMERQUE BACK NEXT MONTH

This month's installment of the series of articles on "A Development Study of the Toll Center District," which are prepared exclusively for publication in TELEPHONE ENGINEER by F. J. Dommerque, Fellow A. I. E. E., has been omitted, but we hope to resume this series with the January issue.

As previously stated the voltage of a lead acid cell is normally 2 volts. Any storage cell of the lead acid type will have this same voltage regardless of the number of plates in multiple as the voltage depends on the type of elements and electrolyte rather than the size or number of plates. The capacity of a storage cell, however, depends on the plate area, also the type of plate, the larger the area the larger the capacity of the battery in amperes. It is customary to rate batteries in terms of ampere-hours, that is, a 100 ampere-hour battery would be one which would be capable of delivering 5 amperes for 20 hours. It is customary to specify ampere hours in terms of a certain discharge rate as the capacity of a cell varies with the rate at which current is taken from the cell, also the lower limit of voltage to which the cell is to be discharged.

As stated above the area of plate surface determines the capacity of a battery in ampere-hours, however, for a given plate area the capacity will depend upon the active material which comes in contact with the acid, and certain types of telephone cells make use of specially prepared lead plates arranged so that a large amount of active material is in contact with the electrolyte for a given plate area. Automobile batteries which are of the lead acid type utilize a relatively large number of thin plates in order that a large amount of current may be drawn from the battery momentarily for starting purposes. In telephone practices, however, large momentary drains seldom occur as the drain is usually more or less uniform and the discharge rates are relatively low therefore heavy plates with smaller surface areas are more suitable inasmuch as a thick plate battery has a considerably longer life than the thinner plate variety.

Types of Cells

There are four principal types of cells used in telephone work. These are:

1.—Open glass type.
2.—Sealed glass type.
3.—Sealed wood type.
4.—Open wood tank type.

These various types are shown in Fig. 5. The open glass type has been quite popular in the past especially in the smaller exchanges. However, in recent years the sealed glass type is replacing the open glass cells as this type has the advantage of being easier to keep clean; and there is no danger of dirt or foreign matter settling in the electrolyte. The sealed wood types are seldom used in telephone work although there is no particular reason why they are not suitable except the fact that the cases are not so easy to keep clean and in good condition as is the case with the glass type. The lead lined wood types are used in the larger exchanges where exceptionally large capacity is required. 24 volt plants of course require 12 cells whereas 48 volt plants require 24 cells. In some cases additional cells are employed and used as counter EMF cells, that is, cells connected so that they may be cut into the battery circuit to buck the normal battery voltage. Such cells are required to equalize the voltage during periods of charge when the voltage per cell may exceed 2 volts. They are seldom employed in the small common battery exchanges. A complete storage cell consists of the positive plate group, using from 2 to 12 or 13 plates and a negative plate group with a similar number of plates, together with a wood or rubber separator placed between the plates for purposes of insulation. These plates being immersed in the acid electrolyte and contained in some sort of cell or jar. Such a combination is referred to as a storage cell. The electrolyte used is not pure acid as concentrated sulphuric acid has a specific gravity of about 1.800 whereas the acid used in storage battery electrolyte is usually about 1.210 gravity. That is a proportion of about 1 volume of concentrated sulphuric acid to about four volumes of water.

Battery Rooms

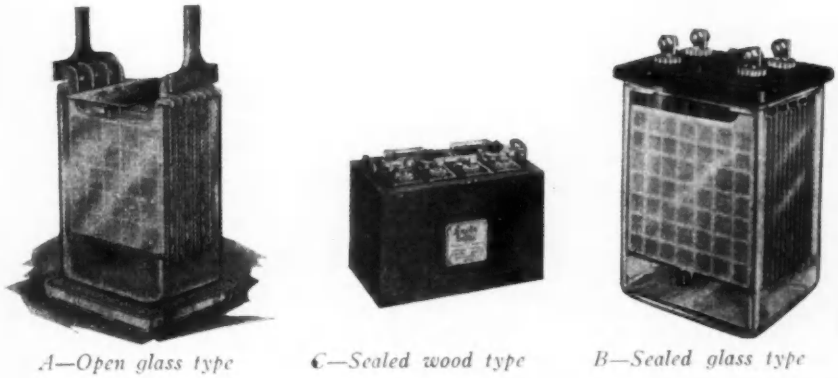
The common battery, in common battery offices, is kept in a separate space which is known as the battery room. Due to the highly corrosive action of sulphuric acid fumes it is necessary that batteries

be in a completely closed room and one that is well ventilated so that there is no possibility of fumes getting into central office equipment such as relays or ringing machines, etc. In small offices the batteries are oftentimes placed in wood cabinets which are provided with a ventilating flue. When batteries are on charge a fine acid spray is thrown off from the battery, especially during the latter part of the charge and on batteries of the open type the spray gets into the air and has a tendency to corrode any metal parts that may be in the room. For this reason the walls and floors of battery rooms are usually painted with a black or gray asphaltic paint. Light fixtures in battery rooms should be of either of the enclosed vapor type, or rubber covered drops with porcelain sockets and with the switch located outside the battery room door. Where glass cells of the open type are used it is customary to place individual cells on a small glass tray filled with fine sand. The closed cell types are ordinarily not mounted in sand trays.

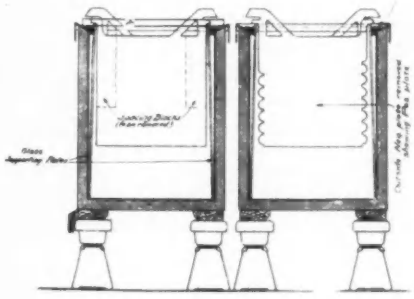
Charging Methods

Central office storage batteries are charged by means of motor generators or various types of rectifiers which convert alternating current into direct current. There are three methods in common use for charging central office storage batteries and these are known as the "Charge-Discharge method," the "semi-floating" and the "full-floating" methods. The charge-discharge method consists of discharging the central office battery to some pre-determined minimum gravity and then starting the charge and continuing until the battery is fully charged, after which the charge is stopped and the battery is allowed to discharge to the minimum gravity specified.

This method of charging has been used to a large extent in the past but is now being replaced in a good many cases by newer methods such as semi-floating or "trickle" charging. The semi-floating method is used to some extent by the larger exchanges. In these exchanges where a generator is used to charge the battery on a charge-discharge basis, the generator can be shut down at night and the battery charged by floating it on rectifiers which supply only about the same amount of current that is demanded by the exchange load. The advantage claimed for this method is a greater reserve battery capacity. The trickle or full-floating method consists in continually charging the battery but at a rate just sufficient to supply the current taken out plus the battery losses. If an average voltage of 2.15 volts per cell is maintained at all times a battery will remain in properly charged condition, an average voltage in excess or lower than this would result in an over-charged or under-charged battery. The charging rate is so adjusted so that at 8 o'clock in the morning the battery is fully charged. This method is becoming very popular as it offers the advantage of more uniform voltage, greater capacity and possibly longer battery life, and it also requires less attention on the part of the maintenance men. Where the trickle or full-floating method is used, batteries can often be of a smaller size than those that would be required where the charge-discharge method is used.



A—Open glass type *C—Sealed wood type* *B—Sealed glass type*



D-Lead Lined Wood Tank Type

Fig 5- Types of Cells

In addition to the regular charge which a storage battery requires it is also necessary to give batteries a periodic "equalizing or over-charge" in order to equalize the charge of all cells and insure that none of the cells are being under-charged. Batteries operated on a charge-discharge basis will require an over-charge about once every two weeks while those operated on a trickle or full float basis will not need an equalization charge oftener than once every two or three months. An equalizing charge is merely an extension of the regular charge. In the case of a trickle charged battery it is necessary to increase the regular charging rate. The regular charge is extended until the specific gravity of the cells shows no increase over a one-hour period. Under this condition all cells should be gassing freely.

Storage Battery Maintenance

Storage batteries are expensive items of central office equipment and the number of years that can be obtained will depend almost entirely on the care given them. It is injurious to any battery cell to either consistently over-charge or under-charge. If charging is continued after the lead sulphate has been converted back into sponge lead and lead peroxide, hydrogen and oxygen gas are formed and there is a tendency for this gas which forms at the negative and the positive plates to dislodge active material which falls to the bottom of the cell thus shortening the life of the battery. If a storage cell is allowed to over discharge or remain in a charged condition for any length of time the lead sulphate which is formed on discharge tends to enter the pores of the plate, resulting in the active material becoming hard and insoluble. The effect of this on the cell is to reduce the cell capacity very materially. It is for this reason that it is desirable to periodically overcharge central office batteries so that all cells can equalize and to prevent the formation of injurious sulphate which results when the active material in the plate is allowed to stand in a discharged condition. It is customary in central office batteries to select one of the 12 or 24 cells as a pilot cell and to take gravity reading of this cell only in order to determine the condition of the charge of the cells. However, on equalizing charges the gravity of all cells are read. While the majority of cells used in telephone work utilize electrolyte having a specific gravity of 1.210 some of the newer cells are designed to operate with specific gravity as high as 1.250 or over. The ampere-hour capacity of a cell is increased by the use of higher gravity, however, such cells have a shorter life than those operated with a lower gravity.

CONVENTION SCHEDULE

Minnesota Telephone Association, Radisson Hotel, Minneapolis, January 26, 27 and 28.

Nebraska Telephone Association, Hotel Paxton, Omaha, February 9, 10 and 11.

Iowa Independent Telephone Association, Fort Des Moines Hotel, Des Moines, Iowa, February 24, 25 and 26.

Ohio Independent Telephone Association, Deshler-Wallick Hotel, Columbus, April 12, 13 and 14.

Kansas Telephone Association, Jayhawk Hotel, Topeka, April 19, 20 and 21.

Elementary Course In Telephone Practice

In This Seventh Installment of an Elementary Course in the Study of the Telephone O. B. Fensholt Explains How the Student May Figure Out the Current, Pressure or Resistance of a Combination; and Tells the Relation Between Magnetism and Electricity

Voltage Lost.

We now have seen how the difference in wire sizes affects the resistance. Also we know how to apply Ohm's law to series, parallel, and combination circuits.

We now should be able to figure out the current, pressure, or resistance of any combination or any part of any combination, if we know the size and length of the line wires, and if we know the rating of our various parts in our circuit.

Let us set up an example as shown by figure 33, representing a building one-half of a mile away from the central office generator. The charging current at the subscriber P. B. X. board is 10 amperes. The voltage at the central office generator is 140 volts. The line wires are 1/10 of an inch in diameter (use 10.7 ohms resistance per mil foot). Now let us find out how much voltage is at the P. B. X. board.

We have found out that the voltage of a series circuit equals the sum of each separate branch. Also we know that the current of a series circuit remains the same. Therefore in figure 33 we know that the current is 10 amperes throughout the whole circuit. Also we know that the voltage lost in each wire plus the voltage at the building equals 140 volts. Then if we can find the voltage lost in the line wires and subtract that from 140 volts at the generator, our remainder would be the voltage at the building.

We know by Ohm's law that $V = O \times A$. Then the volts lost in the line wires will be the ohms multiplied by 10 amperes. Our next problem is to find the resistance $\left(\text{Ohms} - O = \frac{V}{A}\right)$ of the line wires.

Here we know that the resistance of 1 mil foot of copper wire is 10.7 ohms. Our next problem is to find the amount of mil foot of wire used.

The building is one-half mile away. Then each wire is one-half mile long, and as there are two wires it is the same as one mile of wire or a length of 5,280 feet. We also know the wire is 1/10 inch (0.1 in diameter which is equal to 0.100) one hundred mil diameter. The circular mil area will then be 100×100 or 10,000 circular mils. We know 1 mil foot is 10.7 ohms, then 10,000 in parallel would be $10.7 \div 10{,}000$ or 0.00107 ohm, which is the resistance for 1 foot of 1/10" wire, but since we have 5,280 feet of this wire in series we must have $5{,}280 \times 0.00107$ ohm or 5.65 ohms, which is the total resistance of our line wires.

Now to return to our problem of finding the voltage drop in the wire. It is $V = O \times A$, then 5.65 ohms $\times$ 10 amperes equals 56.5 volts lost. Then 140 volts at the generator less 56.5 volts lost equals 83.5 volts at the building.

We will now check this using another method. We have found that the resistance of a series circuit is equal to the sum of the resistances in each branch. Then the resistance of each line wire plus the resistance at the building equals the total resistance, or, reversing it, the total resistance less the resistance of line wires, equals the resistance of the building circuits.

TOO VALUABLE TO LOSE

Whenever we visit a telephone exchange we naturally notice the telephone publications upon the desk; usually Telephone Engineer is not to be found.

Our curiosity leads us to ask the manager for the absence of T. E. from his desk, and the reply is invariably: "Why, if I put our copy of T. E. on the desk it would be snatched up by someone else in the organization and I'd never see it again. So I keep T. E. in my private files, where I can read it page for page as time permits. The information is too valuable to lose."

We know $O = \frac{V}{A}$. Then 140 volts at the generator divided by 10 amperes equals 14 ohms of the whole circuit. We have already found the resistance of the line wires to be 5.65 ohms. Then 14 ohms less 5.65 ohms equals 8.35 ohms, or the resistance of the building circuit.

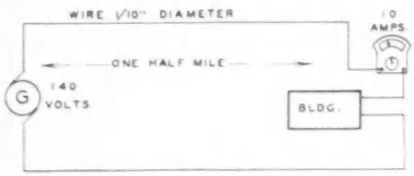


Fig. 33.

By applying Ohm's law, $V = O \times A$. Then 8.35 ohms at the building, multiplied by 10 amperes at the building equals 83.5 volts, which checks with our other answer.

You will then notice that if we know the diameter of any wire and we are given the length we can figure the resistance of this wire by finding the resistance of 1 mil foot, which in copper wire we know to average about 10.7 ohms.

Wire Gauges—Copper wire tables which give us the wire sizes also give us the resistance per 1,000 feet of that wire. Then if we wished to know the resistance of one foot we would divide the resistance of 1,000 feet by 1,000.

Examples—No. 22 copper wire has a resistance of 16.1 ohms per 1,000 feet. One foot would then have $16.1 \div 1{,}000$ or 0.0161 ohm per foot. No. 18 copper wire has a resistance of 6.4 ohms per 1,000 feet. One foot would then have $6.4 \div 1{,}000$ or 0.0064 ohm per foot.

General Review Questions.

1. What is the term used for a quantity of electricity at rest?
2. What term is used for an electric current?
3. What term is used for electrical pressure?
4. What term is used for electrical resistance?
5. What are three ways of changing the resistance of a circuit?
6. What is Ohm's law?
7. What is the rule and formula for finding volts?
8. What is the rule and formula for finding amperes?
9. What is the rule and formula for finding ohms?
10. Show one formula that can be used for all three.
11. Explain how this formula (Question 10) is used.
12. What kinds of electrical circuits are there?
13. What is the rule for finding the amperes of a series circuit?
14. What is the rule for finding the volts of a series circuit?
15. What is the rule for finding the ohms of a series circuit?
16. What is the rule for finding the amperes of a parallel circuit?
17. What is the rule for finding the volts of a parallel circuit?
18. What is the rule for finding the ohms of a parallel circuit?
19. What part of an inch is 1 mil?
20. How many mils in 2/5 of an inch?
21. How many mils in 0.032 of an inch?
22. What is meant by square mil area?
23. What is meant by circular mil area?

24. If a round wire has a diameter of 120 mils, what is the area?

25. A round wire has a diameter of ½ inch. What will be the area?

26. A copper wire (10.7 ohms per mil foot) is 375 ft. long, and has a diameter of 0.035 mils. What is the total resistance of the wire?

Magnetism.

We have now covered enough of Ohm's law and wire sizes so that we understand and appreciate the difference between ohms, volts, and amperes, and we understand the effect of wire sizes. We understand that amperes is a current of electricity, or electricity in motion, and that this current can be varied by either regulating the voltage or the resistance. We also appreciate the effect of the various sizes of wires.

Our telephone apparatus and circuits are composed of two things: electricity and magnetism. Therefore it will be necessary that we also study something about magnetism.

Perhaps one of the first "magical" things that interested us in our childhood days was magnetism—in the form of a small horseshoe magnet. By playing with this magnet we discovered various articles which could be affected by magnetism. We soon discovered that a nail, iron screw, needle, or any other iron or steel object would "stick" to our horseshoe, while pins (brass), money, lead, paper, and glass would not "stick." We also discovered that we could hold our horseshoe against one side of a piece of glass, and put a needle on the other side of the glass and that the "stickiness" would go right through the glass and hold the needle. In our childhood days this "stickiness was quite a mystery, and if you have never studied magnetism it still is a mystery to you, except that now you are satisfied to call it magnetism.

Magnetism and electricity are very closely related, that is, you can produce electricity with magnetism or you can produce magnetism with electricity by reversing your condition. This, however, we will study later.

When we played with our horseshoe magnet we discovered that after we had picked up a certain nail several times that this nail also became a magnet, and that now this nail would pick up light objects, such as needles. We also discovered that after this nail had become "magnetized" the head of the nail would always go to one side of our horseshoe magnet, and the point to the other side, and if we would turn our nail around that "something" would push it away from the magnet.

All these things mystified us in our childhood days, but this will all be explained to you as we go along, because our telephone principles are built up on this pulling and pushing effect of magnetism, and we are able to regulate the amount or strength of this push or pull to meet our requirements.

All our relays, ringers, induction coils, boosters, transformers, transposition problems, etc., are all problems in magnetism, electricity, and wire sizes.

Many centuries ago it was discovered that a certain ore in Asia had the power of attracting iron or smaller particles of this ore. This ore is called lodestone, and found in great abundance near Magnesia in Asia. The Greeks therefore called this ore "magnetite" and the magnetite was known then to be "magnetic." This ore is also found in the Scandinavian countries and many places in this country.

Some time later it was discovered that if a piece of this ore were flattened out like a bar and suspended in the center it would point north and south. It was also discovered that should they turn this bar around in various directions the same end of the bar would always point to the north. They therefore called this end of the bar the north pole, and the other end the south pole. This was perhaps the first discovery of a compass. Magnetized needles were then made for sailors and explorers, and these needles were called compasses.

Several centuries later it was discovered that these "magnets" had a repelling power as well as an attracting power. It was discovered that if you had two separate magnets and suspended one by a string, and if you would hold the north pole of one near the south pole of the other that there would be a power of attraction, but if you held the north pole of one near the north pole of the other there was a sort of push, or a power of repelling.

We can then set up a rule as follows:

(*Continued on page* 38.)

Copper Wire Table.—Resistance of Soft or Annealed Copper Wire.

B. & S. gauge, No.	Diameter in mils, d	Area in circular mils, d^2	Ohms per 1,000 ft. at 20° C. or 68° F.	Pounds per 1,000 ft.
0000	460.00	211,600	0.04893	640.5
000	409.64	167,810	0.06170	508.0
00	364.80	133,080	0.07780	402.8
0	324.86	105,530	0.09811	319.5
1	289.30	83,694	0.1237	253.3
2	257.63	66,373	0.1560	200.9
3	229.42	52,634	0.1967	159.3
4	204.31	41,742	0.2480	126.4
5	181.94	33,102	0.3128	100.2
6	162.02	26,250	0.3944	79.46
7	144.28	20,816	0.4973	63.02
8	129.49	16,509	0.6271	49.98
9	114.43	13,094	0.7908	39.63
10	101.89	10,381	0.9972	31.43
11	90.742	8,234.0	1.257	24.93
12	80.808	6,529.9	1.586	19.77
13	71.961	5,178.4	1.999	15.68
14	64.084	4,106.8	2.521	12.43
15	57.068	3,256.7	3.179	9.858
16	50.820	2,582.9	4.009	7.818
17	45.257	2,048.2	5.055	6.200
18	40.303	1,624.3	6.374	4.917
19	35.890	1,288.1	8.038	3.899
20	31.961	1,021.5	10.14	3.092
21	28.462	810.10	12.78	2.452
22	25.347	642.40	16.12	1.945
23	22.571	509.45	20.32	1.542
24	20.100	404.01	25.63	1.223
25	17.900	320.40	32.31	0.9699
26	15.940	254.10	40.75	0.7692
27	14.195	201.50	51.38	0.6100
28	12.641	159.79	64.79	0.4837
29	11.257	126.72	81.70	0.3836
30	10.025	100.50	103.0	0.3042
31	8.928	79.70	129.9	0.2413
32	7.950	63.21	163.8	0.1913
33	7.080	50.13	206.6	0.1517
34	6.305	39.75	260.5	0.1203
35	5.615	31.52	328.4	0.0954
36	5.000	25.00	414.2	0.0757
37	4.453	19.82	522.2	0.0600
38	3.965	15.72	658.5	0.0476
39	3.531	12.47	830.4	0.0377
40	3.145	9.89	1047	0.0299

Telephone News From the Southwest

Notes of Telephone and Utility Interests in the Central Southwest Which Previously Were Reported for Transmitter and Electrical Journal, a Regional Magazine of that District Which Has Been Absorbed by TELEPHONE ENGINEER, Appear in the Following Columns

Tidings From Texas

Improvements at Elgin

The Southwest Telephone company, which operates the local telephone system at Elgin, Texas, has begun the work of reconstructing the entire plant. Included in the improvements will be a new office building and new central office equipment. Complete cable construction will feature the outside plant.

Amarillo Rate War

The telephone rate war at Amarillo, Texas, was renewed on November 1st, when the Chamber of Commerce of that city called on the 3,000 patrons of the Southwestern Bell Telephone company that had petitioned for a further reduction in rates, to have their telephones removed.

Mayor Ernest O. Thompson, owner of Amarillo's two largest hotels was among the first to order the service discontinued. Included in the order were all city and city employe telephones except those in the police and fire departments. The Chamber of Commerce was among those whose telephones were ordered out. The telephone company granted reductions in rates on September 1st, amounting to 25 cents on residence telephones and 50 cents on business telephones, but the patrons of the company were not satisfied with the reduction.

At the close of business on November 3d, officials of the Southwestern Bell Telephone company stated that but forty patrons of the company had ordered their service discontinued, and that of this number thirteen had been persuaded to leave the telephones connected so that there were but twenty-seven removals as a result of the request made by the Chamber of Commerce.

Improvements at Aransas Pass

The Texas Telephone company will complete the installation of an entirely new telephone exchange at Aransas Pass by the end of December. A new American Electric common battery switchboard and associate equipment is being installed and the outside lines are being rebuilt. The latter work is being done under the supervision of foreman George Brown of Sherman.

Elgin Gets New Switchboard

The Southwest Telephone company is rebuilding its telephone exchange at Elgin. Included in the improvements are a new office building, a new magneto switchboard with 165 lines installed, and 8,000 feet of aerial cable. The work will be completed early in the new year.

Dial System for Sweetwater

The Southwestern Bell Telephone company cut over to its new dial exchange at Sweetwater on December 5th. The new exchange is housed in a new office building consisting of two stories and a basement. The initial installation carries a capacity of 2,300 lines.

New Exchange at Kilgore

In response to a demand for increased telephone facilities, the Southwestern States Telephone company has just completed the installation of new central office and outside equipment at Kilgore.

The switchboard, which is a Kellogg Master-Built common battery, is of 800 line capacity and has been located in an office building recently remodeled for the use of the telephone company. Seven thousand feet of aerial cable have been added to the outside construction. Kilgore is in the world-famous East Texas oil field and the population has grown from 700 a year ago to 7,000 at the present time. During the same period the number of telephones has increased from less than a hundred to more than five hundred. A new standard form directory is being printed and will soon be ready for distribution.

Company Expands at Gladewater

The Southwest Telephone company has added 100 lines to its switchboard at Gladewater recently, and 3,000 feet of aerial cable have been added to the outside plant. Gladewater is in the East Texas oil field and has grown rapidly during the past year. From a sleepy country village it has grown to a bustling city of 3,500 population, while the number of telephone subscribers has more than quadrupled.

Armistice Declared at Amarillo

Armistice day brought to Amarillo a cessation of its telephone rate controversy. Following an agreement reached on Tuesday night, November 10, between the city and the Southwestern Bell Telephone company that negotiations are to be started soon looking to a renewal of the company's franchise, Mayor Thompson the following day gave orders for telephone service to be reconnected to his two hotels, the largest in the city. The 10-day campaign in behalf of the lower rates was thus brought to a close.

Northern Texas Managers Meet

Local managers of the eleven exchanges of the Northern Texas Telephone company met in conference with General Manager S. H. Shutt at Sherman on November 25th. The day was devoted largely to a study of tariff regulations and standard rules of service. Luncheon was served at noon at the Grayson Hotel. Out of town visitors were Manager Hugh Egan and Cashier Frances Tompkins of Denton, Manager J. I. Boon and Cashier Martha Young of Bonham, and local Managers Chad E. Shock, Garland, C. B. Chitty, Wylie, Miss Aethra Philpott, Plano, M. G. Bush, Howe, Z. B. McCarver, Whitesboro, Mrs. Bess Moncrief, Collinsville, Miss Isabel Mershon, Tioga and Mrs. Laura McAdams, Pilot Point.

Giddings Joins the Elite

The little city of Giddings proudly boasts a new telephone system, recently installed at that place. The Southwest Telephone company, owners of the franchise in Giddings has completed the installation of a new two-position, 350-line magneto switchboard with a 400-pair main frame. Two hundred new poles were added to the outside plant and 10,000 feet of aerial cable was installed. The outside work was done under the direction of construction foreman I. H. Humphreys.

District Meeting Held at Waco

A district convention of the Texas Independent Telephone association was held at Waco on November 19th and 20th. The first session was held on the afternoon of November 19th and was devoted to a discussion of legislative matters by Senator John Bailey, legal representative of the association. At the close of Senator Bailey's address, Miss Fannie Woods, manager of the Gulf States Telephone company at Hico gave a very interesting talk on "Collections."

On Friday the following program was carried out: "Sales of Service," by W.

H. Hemphill, sales supervisor of the Southwest Telephone company, of Dallas; "Keeping Fit," by Miss Elma Ballard, chief operator of the Texas Long Distance Telephone company of Waco; "New Toll Operating Practices," by Wm. Swan, of the Southwestern Bell Telephone company of Dallas; "Handling Switchboard Equipment," by Joe Bennett, of the Three States Telephone company of Dallas; and "Plant Maintenance" by I. L. Fullerton, plant chief of Texas Long Distance Telephone company of Waco. The local telephone companies at Waco were hosts at a banquet served the visitors at the Hilton Hotel at 1:30 P. M. There were a total of 114 present at the meeting.

Observations From Oklahoma

Reduce Rates in Oklahoma Towns

The Oklahoma Corporation commission ordered telephone rates reduced in four Oklahoma towns, effective December 1, 1931. Three of the towns, Grandfield, Comanche and Cement, are served by the Southwestern States Telephone company. New rates applying to Grandfield and Comanche are: business individual line service, $3 per month; residence individual line service, $1.75 ,per month; rural multi-party line service, $1.25 per month. This is a reduction of 50c per month on business individual line service and 25c per month on residence individual line and rural multi-party line service. New rates for Cement were fixed at $3 per month for business and $1.75 per month for residence telephones, which is a reduction of 50c per month on business and 25c per month on residence telephones. Rates of the Southwest Telephone company applying to Devol, Okla., were reduced from $3.50 to $3 per month on business telephones, from $2 to $1.75 per month for residence telephones and from $1.50 to $1.25 per month for rural service.

Hold Final District Meetings

Two more district meetings of the Telephone Division, Oklahoma Utilities association, were held in December. One was held at Okeene, December 8, under auspices of the Okeene Mutual Telephone company and the other at Guyman, December 10, under auspices of the Western Telephone corporation. These probably will be the last of the 1931 series of telephone meetings which have been held in several sections of the state.

New Location for Bethany Exchange

The office and exchange of the Southwestern Bell Telephone company at Bethany, Okla., was recently moved to a new location. New equipment consists of a one-position switchboard. The change was made in the interests of better service to patrons, according to company officials.

Lawton Installations Increase

The Lawton (Okla.) Constitution reports that despite unfavorable business conditions the number of gas and light meters and telephones established in Lawton up to September 30, 1931, showed an increase over a similar period of last year. The Southwestern Bell Telephone company records show an increase of 94 telephones in Lawton during that period.

Telephone Appraisal Progresses

Field workers of the Oklahoma corporation commission are making progress in appraisal of telephone properties in Oklahoma. Six inspection groups began working in the field on August 1 and by October 31 they had completed inspection of approximately 2,300 miles or nearly half of the line mileage to be inspected. The appraisals are being made by the telephone engineering department of the Oklahoma corporation commission, in pursuance of a resolution passed by the last legislature authorizing and directing the commission to make a full and complete investigation of telephone rates and charges.

Place Geary Lines Overhead

The Geary Telephone company is making preparation to place all lines in the business district in overhead cables, and poles for this purpose are now being set. About 2,000 feet of cable will be installed.

Fire Destroys Lindsay Exchange

The inside exchange of the Southwest Telephone company at Lindsay, Okla., was practically destroyed by a recent fire which burned down two buildings, one of which was occupied in part by the telephone company's central office. The company established long distance service within 2½ hours after its equipment was destroyed, according to L. M. Baker, district manager. Local exchange service was installed within a few days. The company rented temporary quarters in another building.

Judge Sustains Bell Demurrer

A demurrer filed by the Southwestern Bell Telephone company in district court here against a suit brought by Governor William H. Murray to collect $644,203 in fees and penalties from the Bell company was sustained November 24 by District Judge R. P. Hill at Oklahoma City.

The telephone company, in its demurrer, attacked the constitutionality of the law on which the suit was based on the grounds that the law was discriminatory and also contended that the law was a revenue raising measure and as such was not properly passed by the legislature and that it interfered with interstate commerce. In sustaining the demurrer Judge Hill stated that his ruling did not affect the 1/10th of 1 per cent fee paid on capital invested upon original entry of a foreign corporation into Oklahoma. The theory of the decision, however, was that when a foreign corporation has paid the original fee it becomes a citizen of the state and that additional fees would be a discrimination between it and a domestic corporation.

It was contended in Governor Murray's suit that the company should have paid the foregoing fee each year and that it was in arrears in these payments for a period of several years. The suit was filed at the direction of Governor Murray as a part of his efforts to bring about a reduction of telephone rates in the state.

TELEPHONE LATEST AID TO DIPLOMACY

The latest gift of science to diplomacy, making possible personal communication between representatives of great nations, was installed recently at the state department in Washington.

It is a new development in telephony, consisting of an ingenious arrangement of amplifiers and multiple receivers, which will enable the heads of governments in far corners of the world to speak with Secretary Henry L. Stimson while ten of his assistants listen in.

Seated around a conference table in the Secretary's office with headsets over their ears, the Secretary's entire staff of experts will be able to hear, jot down notes and exchange remarks on the conversation.

The system described by Secretary Stimson as the first of its kind to be installed anywhere, is expected to increase the use and usefulness of the long-distance telephone and radiophone, which have come into increasing use in communication between world capitals in the last year.

Indiana Associated Telephone corporation will move its headquarters from Elkhart, Ind., to Lafayette, Ind. This company was formed by consolidation of 12 telephone companies.

Fighting Decay and Insect Attack on Poles

In This Article E. D. Graff Explains Fungus Growth; Lists and Describes Standard Processes of Treating Telephone Poles, to Combat the Termite and Decay, in Common Use; Tells of Constantly Increasing Demand for Full Pressure Treated Poles

The loss each year in the United States caused by decay alone amounts to approximately one-fifth of the annual lumber cut and has been estimated to exceed 205 million dollars. In addition to decay, Government estimates show that 45 million dollars' worth of damage has been done to timber products each year by wood-boring insects—chiefly by the termite, that small insect resembling the white ant, which is active over the greater part of the United States.

This damage, totaling 250 million dollars annually, can be prevented by using chemically preserved lumber in locations and for parts of structures which because of exposure or accessibility are susceptible to either decay or insect attack. Fortunately, the same treatment which inhibits the development of decay fungi prevents also insect attack.

Pressure-treated poles supporting wires for Gulf States Telephone Co., Statesville, Texas.

Lumber and pole interests in this country, with and through the National Committee on Wood Utilization, are working to eliminate this enormous waste, and it is interesting to note that the amount of wood chemically preserved in the United States increased from the equivalent of 911,357,028 board feet in 1909, to the equivalent of 4,344,108,564 board feet in 1929.

Decay is caused by fungi, a low parasitic form of plant life. Fungus spores which are so minute that they can be seen only with the aid of a microscope, are prolific and float through the air in myriads, often for long distances. Lodging in the cracks and crevices of timber, they find ideal conditions for germination and soon send forth filaments which quickly penetrate the wood in all directions, transforming wood fibre into food. This wood fibre is consumed as food by the fungus in its growth and the wood quickly reaches the state known as rotten.

Four conditions are necessary to fungus growth: viz., air, moisture, suitable temperatures, and, finally, food. In exposed structures it is seldom practicable to eliminate the moisture supply necessary to fungus development and air can not be wholly excluded. The food supply, however, can, by a toxic chemical which will penetrate the wood and remain in it, be rendered unavailable. Rendering the wood unsuitable for food is the basic principle of wood-preservation and is economically practicable.

After suitable trees have been felled in the forest, they are immediately peeled, all the outer and inner bark being entirely removed, and are promptly shipped to storage yards at the plant. Poles for storage are carefully ranged in groups according to top sizes or circumference measurements six feet from the butt.

In stacking the poles for seasoning, each layer is separated from the next by creosoted spacing strips to permit a ready circulation of air around the timber, and the piles are stored on creosoted skids, away from any contact with the ground.

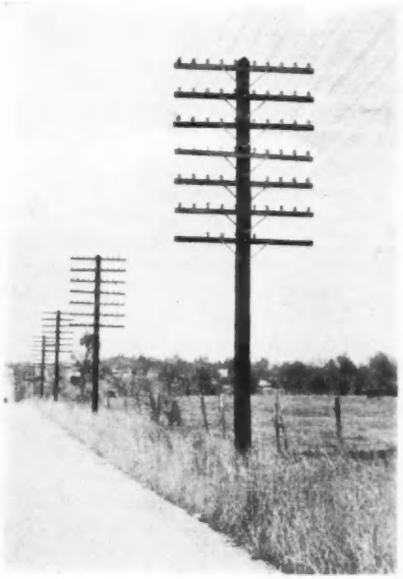
The general method of protecting telephone poles from decay is by treatment with coal-tar creosote. Creosote is a distillate of coal gas or coke oven tar. Long years of study and use both in this country and abroad have definitely determined the steps necessary to safeguard the manufacture of creosote and make it an effective wood-preserver.

Engineering societies have set forth the necessary qualifications in standard specifications and have outlined methods to determine the purity of the product, all of which are open to the public.

When shipments of creosote oil are received at the treating plant, samples are analyzed. The fact that the quality meets the specification is established before the oil is moved to the working tanks. Rechecks to insure quality are frequently made of samples taken during treating operations.

Two standard processes of treatment are in common use: i. e., the full-cell and empty-cell. The empty-cell process, however, includes two processes—the empty-cell process with initial air and the empty-cell process without initial air. In the full-cell process the wood in the cylinder is subjected to a preliminary vacuum after which the oil is admitted to the cylinder. Pressures and temperatures are then raised and maintained until the stipulated amount of preservative has been injected into the wood, after which a final vacuum is drawn and maintained for a few minutes until the wood can be removed free of dripping preservative.

In the empty-cell process with initial air, or Rueping process, the preliminary vacuum is omitted, and instead, the wood is subjected to a charge of compressed air. Following the initial air charge, oil is admitted to the cylinder under pressure. Temperatures and pressures are raised as in the full-cell process and held until sufficient preservative has been injected to insure a final retention of the stipulated amount. The air imprisoned in the wood expands and with the help of the final vacuum expels the free oil but leaves the cell walls impregnated. Practically all of the southern pine poles are being treated by the Rueping process because of the superior penetration that is obtained.



Pressure-treated poles in line of A. T. & T. Co., along highway near Joplin, Mo.

The empty-cell process without initial air, which is somewhat similar to that with initial air, depends upon the air naturally existing in the wood, with the help of the final vacuum, to force out the excess oil after the pressure period.

The above describes the treatment of air seasoned poles. It is, however, often desirable to treat unseasoned poles. Treatment in this case must be preceded by a preparation process, usually steaming. Steaming at low pressures in the treating cylinder vaporizes the moisture and heats

(*Continued on page 38.*)

Activities of "B" Switchboard Supervisor

John H. Levis, Jr., Telephone Engineer, Rochester, N. Y., Here Tells Function of "B" Operator's Outgoing Trunk to "B" Supervisor's Circuit in the Sixteenth Installment of His Series of Articles on the Subject of the Straightforward Trunking System

In all "B" operators' incoming trunk positions a supervisor's circuit and equipment is used, regardless of the type of trunk circuit employed. The supervisor is an operator that is well trained in all the operating practices used in central office operation.

Each supervisor at the "B" switchboard has from six to nine "B" positions to supervise. Her duties are to see that all "B" positions are properly occupied when the incoming traffic becomes heavy, or to reduce the operating force when the incoming traffic becomes light. She also has to see that the incoming calls are being handled properly to speed up the answering and completing of the calls. Another duty is to see that all circuits are in proper working order and to report any circuit trouble that develops to the plant department.

The "B" supervisor many times has to handle incoming trunk circuit calls when the reguar "B" operator cannot get the proper information. The "B" operator in this case plugs the trunk plug into an idle "B" outgoing trunk to the "B" supervisor. This causes the "B" supervisor's division lamp to light and a single stroke gong to operate. The bell is to attract the attention of the "B" supervisor and the division lamp is to indicate the division of "B" operators from which the call originated.

The supervisor's talking circuit is multipled in each "B" board section of a division so that when answering a call all that is necessary to do is to plug the receiver and transmitter into the talking jack. This act restores the division lamp and removes the signal bell from the circuit. The supervisor is now in connection with the distant office station and she obtains the information regarding the call from the station.

Should the "B" supervisor require the services of another operator, she uses a multiple of what is called the "B" supervisor's trunk to the "A" board provided in the "B" board. This multiple is used only by the "B" supervisors.

The incoming "B" supervisor's circuit has connected to it a plug circuit, which is also multipled and appears in each section, in which the "B" supervisor's listening jack is located.

This plug circuit is used when the "B" supervisor wants to call an "A" operator. The supervisor selects an idle outgoing trunk to the "A" board and plugs the plug circuit of the supervisor's circuit into the jack.

The "A" board end of the trunk to the "A" board terminates in the ordinary answering jack and lamp circuit consisting of line and cut-off relay. The "A" operator answers the signal in the usual way and talks to the supervisor, and if the call is to be extended to any other point it is done by the "A" operator, who rings or calls in the usual way. All of the time the "B" supervisor's plug circuit is in the "A" trunk circuit. The station on the "B" incoming trunk is split from the conversation being carried on by the "B" supervisor and the "A" operator or between other points. When the "B" supervisor desires to converse with the calling station she removes the plug circuit from the outgoing trunk jack.

This type of supervisor's circuit is very efficient in handling calls referred to a supervisor on which information is required.

In connection with the supervisor's circuit, there is a section pilot lamp and key. This circuit is used by the "B" operators in any section when the supervisor's services are required in reporting trouble, seeking advice or providing relief.

The section and division pilot lamps are located in the upper frieze panel above the local line multiple and are so arranged that they can be seen from any angle. The single stroke call bell is located on the roof of the "B" switchboard.

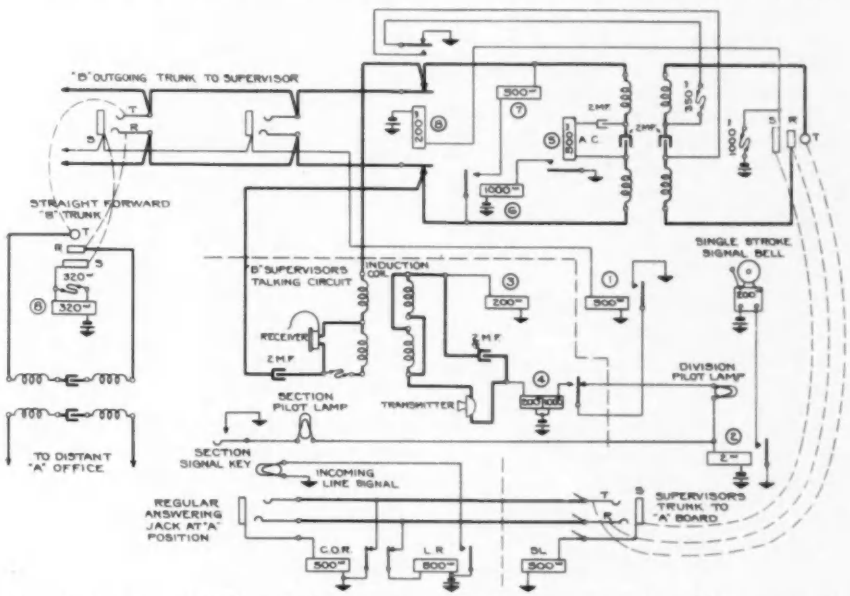
The operation of the complete "B" operator's trunk to the supervisor is as follows:

When an incoming call on the straight forward trunk is to be referred to the "B" supervisor, the "B" operator operates the non-ring common key and then tests for an idle outgoing trunk to the supervisor. The operation of the non-ring key and the test have been described in previous issues of "Telephone Engineer."

By referring to the complete circuit of the "B" supervisor's circuit in the accompanying diagram, it is seen that the plugging in of the "B" trunk circuit into the supervisor's multiple jack causes the No. 1 relay to operate from the sleeve of the "B" trunk circuit. The operation of the No. 1 relay causes the division pilot lamp to light, indicating which division is calling. The No. 2 relay, which is in series with the division pilot lamp, also operates, which closes the circuit of the single stroke signal bell, attracting the attention of the supervisor.

The "B" supervisor plugs her talking set into the talking jack of the division which is calling. This causes the No. 4 relay to operate, opening the division pilot lamp. This releases the No. 2 relay, which restores the single stroke signal bell. The No. 4 relay operates through the supervisor's transmitter, induction coil and the primary and impedance coil No. 3. The No. 4 relay is

(*Continued on page* 40.)



Circuit diagram of "B" straightforward trunk circuit connected to "B" supervisor's circuit

Modern Telephone Accounting Practice

Handling Subscribers' Accounts Is First Problem in Accounting, Says F. A. Bowdle; Small Companies Use Subscribers' Ledger While Larger Companies Use Stub System of Accounts. The Second Problem, Disbursements Accounting, Includes Proper Classification of Expenditures

Modern accounting practice as followed by the telephone industry is naturally divided into two sections, revenue accounting and disbursements accounting, which are combined in a final analysis of a company's financial condition.

Revenue Accounting in the average telephone company of moderate size is logically a function of the commercial department and includes the keeping of subscribers' rental and toll accounts and any other accounts which may yield any type of revenue. It involves handling these accounts in a businesslike and intelligible manner and it includes the collection and subsequent handling of the receipts.

Disbursements Accounting may be a function of any department but in the average telephone company of moderate size it is delegated also to the commercial department which is authorized to make all disbursements upon receipt of the proper requisitions from the departments actually incurring the expense.

In an article of this nature it is obviously impossible to consider all possible problems in detail but the author will endeavor to discuss briefly some of the methods and attendant difficulties he has met during the past twenty years as both a practicing accountant and an operator of telephone companies.

Revenue Accounting

The handling of subscribers' accounts is the first problem to be considered in a discussion of revenue accounting. The method to be followed is determined largely by the number of such accounts. When the company does not operate over 2,000 stations the simplest method is to handle these accounts by means of the well known subscribers' ledger, which lists rental and toll charges each month and as every book-keeper knows is a matter of making the proper debits and credits, being mindful to keep them in balance. Each subscriber is billed monthly (or quarterly) as the case may be, for the advance month's rental and the past month's toll. According to the best practice all collections are kept intact and banked at the close of each day, no petty cash being paid out of receipts.

While this system works nicely for the company under 2,000 subscribers, when it is larger the work becomes unwieldy and hard to keep in balance as the possibility of error increases with each ledger page. Most larger companies use what is known as the stub system of accounts instead of a subscribers' ledger. Each month a statement is prepared for each subscriber listing advance rental and the past month's toll charges. This statement is made in duplicate or triplicate if the company

A form much used by Class C companies.

Voucher No. ____ Date ____ 30

Exchange ____ Jr. Pg. ____

Debit ____ Amt. $ ____

Credit ____ Amt. $ ____

	I OPERATING EXPENSES	Debit	Credit
604	Repairs of Wire Plant		
614	Repairs of Equipment		
620	Station Removals and Changes		
628	Depreciation of Plant and Equip.		
642	Maintenance		
	a—Land and Buildings		
	b—Other Maintenance		
666	Operators Wages		
668	Other Traffic Expense		
	a—Cost of Power Purchased		
	b— " " Plant Labor		
	c— " " Lineering Exchange		
	d— " " Measured Service		
	e—Other Traffic Expense		
672	General Office Salaries		
680	Other General Expense		
	a—Office Supplies and Expenses		
	b—Directory Expense		
	c—Rents		
	d—Insurance		
	e—Law Expense		
	f—Accident and Damage Claims		
	g—Advertising		
	h—Other General Expense		
690	Total Operating Expenses		
	II CONSTRUCTION		
205	Intangibles		
210	Land and Buildings		
220	Central Office Equipment		
230	Station Equipment		
240	Exchange Lines		
241	" Underground		
245	" Submarine		
248	Toll Lines		
260	General Equipment		
270	Undistributed Const. Expenditures		
280	Plant and Equipment Purchased		
	Total Construction		

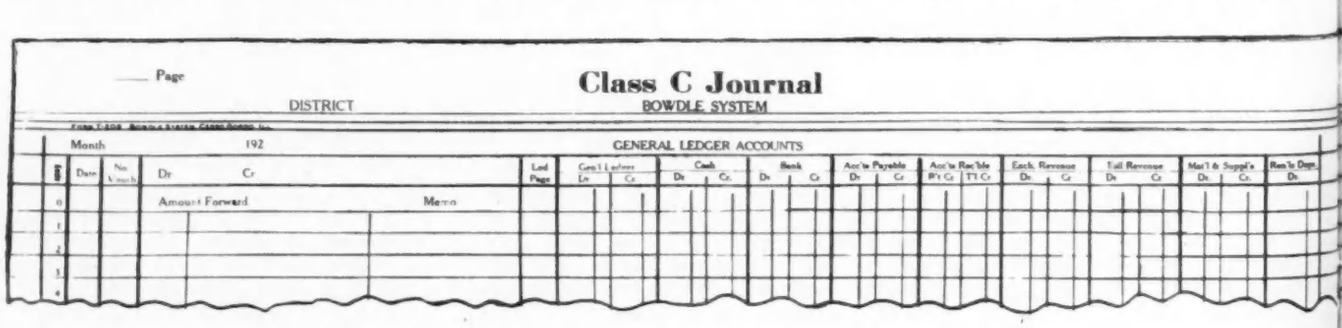
	III RENEWALS	Debit	Credit
210	Land and Buildings		
220	General Office Equipment		
230	Station Equipment		
240	Exchange Lines		
241	" Underground		
245	" Submarine		
248	Toll Lines		
260	General Equipment		
	Total Renewals		
	IV STOREHOUSE		
120	a—Land and Buildings		
	b—General Office Equipment		
	c—Station Equipment		
	d—Exchange Lines		
	e— " Underground		
	f— " Submarine		
	g—Toll Lines		
	h—General Equipment		
	i—Undistributed Material		
	Total Storehouse		
	V ACCOUNTS RECEIVABLE		
121	Subscribers Rental Accounts		
122	Toll		
130	Miscellaneous		
139	Other Accounts Receivable		
	Total Accounts Receivable		
	VI OPERATING REVENUE		
500	Exchange Revenue		
540	Toll		
580	Miscellaneous		
585	Licenses Cr.		
585	" Dr.		
	Total Telephone Oper. Revenue		
	GENERAL ACCOUNTS		
141	Tel. Accounts on Bills Receivable		
200	Accounts Closed		
440	Other Operating Income		
660	Other Operating Expense		
700	Taxes Assignable		
800	Miscellaneous Charges to Investment		

One of voucher forms used by many Class C companies for disbursements accounting

maintains a separate accounting department. One copy is sent to the subscriber, one is retained in the commercial office and where an accounting department is maintained, one copy is sent to that department also, no attempt being made to itemize each subscriber's account on any one book as is the case when using the previously mentioned ledger. When the subscriber presents his copy with the proper payment it is stamped to show receipt of payment and returned to him. The payment is noted on the commercial office copy and when necessary the accounting department is notified of each day's payments. When the collection of accounts is complete the total amount as shown by the stubs and the actual cash collected should be identical. It is well at this time to stress again the statement that the cashier must understand that any payments of petty cash should not be made from collections, but from a special sum set aside for such purposes, which will be explained more in detail in the discussion of Disbursements Accounting.

At this point it might be well to call attention to the matter of collection practices. It is obvious that in different types of communities the methods used must vary. In a city of some size where fixed and regular salaries are the rule with the average subscriber the company may reasonably expect a full settlement of each account each month. In a community where there are a majority of rural subscribers this practice is apt to meet with considerable opposition. Many farmers feel that since their income varies greatly from month to month, being almost negligible during some months and correspondingly great during the months when they harvest their products, they would rather make their payments in a lump sum quarterly or even twice a year. They are accorded this favor by most local tradespeople and they fail to understand why the telephone company is any different from their grocer or implement dealer.

Probably the best method of handling such a situation is to classify all subscribers according to a well defined credit rating system based on past experience in collecting their accounts. If, for example, we know that Mr. Jones is a farmer of moderate circumstances and he will settle his account in full at harvest time


Page

Class C Journal

DISTRICT

BOWDLE SYSTEM

Month 192

GENERAL LEDGER ACCOUNTS

Day	Date	No. Vouch	Dr Cr	Led Page	Cash Ledger Dr	Cash Ledger Cr	Cash Dr	Cash Cr	Bank Dr	Bank Cr	Acc'ts Payable Dr	Acc'ts Payable Cr	Acc'ts Rec'ble Pr's Cr	Acc'ts Rec'ble T'l's Cr	Exch. Revenue Dr	Exch. Revenue Cr	Toll Revenue Dr	Toll Revenue Cr	Mat'l & Suppl's Dr	Mat'l & Suppl's Cr	Rent's Dept. Dr
0			Amount Forward Memo																		
1																					
2																					
3																					
4																					

and has always had the reputation in the community of being a man who pays his bills, are we not justified in carrying his account on our books and refraining from taking any embarrassing collection measures? On the other hand if his neighbor, Mr. Brown, is known from past experience and reputation to be inclined to evade paying his bills are we not equally justified in discriminating against him in the matter of continuing to extend him credit? Some companies even go so far as to inaugurate a very complete system of credit rating in which a subscriber is classified as A, B, C and D according to his ability and inclination to settle his accounts. It is wise to consider public relations in this connection and try to find the point at which the collections are best handled without incurring public disapproval. A well developed system of advertising, showing the public a little of the inner workings of the telephone company, tending to personalize its functions and point out the fact that the company must depend upon its patrons as much as they depend upon it, is often of great benefit to the management in keeping its collections up to date.

Disbursements Accounting

Disbursements accounting includes the proper classification of all expenditures, whether they be salaries, supplies, new construction, renewals, taxes, in short every possible expenditure which a telephone company may be required to make in the transaction of its business. It is not confined to any single department, although it is customary for small companies to handle all actual payment of money through the commercial department. Even when this is the case it is still necessary for the department involved to classify its expenses.

Many companies find it to their advantage to use the voucher system in connection with all expenditures. There are on the market at present voucher forms upon which may be distributed according to their respective natures all the various expenses encountered, whether they be plant, traffic or commercial expenes. Some companies make a practice of issuing a voucher for each check issued but it is readily perceived that in even the average sized company this is often quite burdensome as many items will be found which may be classified together on the same voucher. In general it is the best policy to include more than one check in a voucher. For example all operators' salaries may as well be included on the same voucher as that expense all comes under the same classification. Except in the case of a large company, where there may be special duties assigned to its various commercial employes it is permissible to classify all general office checks together on the same voucher. When all vouchers have been properly distributed, monthly or quarterly as the case may be, they are ready for transcription to the cash journal where revenues and expenses are combined.

In a previous paragraph the point was stressed that all collections should be banked and no money paid out on petty cash items except from a special petty cash account. The generally accepted procedure is to establish a small fund for handling these items. The treasurer or auditor of disbursements issues to the cashier a check for the desired amount. This sum is then paid out only upon receipt of signed vouchers stating the nature of the payments. These vouchers are returned to the treasurer or auditor with the next requisition for cash. While this may seem on the surface a useless transaction, its value becomes apparent when we consider that it leaves the collections from subscribers' accounts intact to tally exactly with bank deposits. It also makes the preparation of distribution vouchers for petty cash items much simpler, as there are checks instead of a large number of individual payments.

Plant Accounting

While plant accounting is a phase of disbursements accounting it often becomes complicated to the extent that a special treatment of it in this article was thought wise.

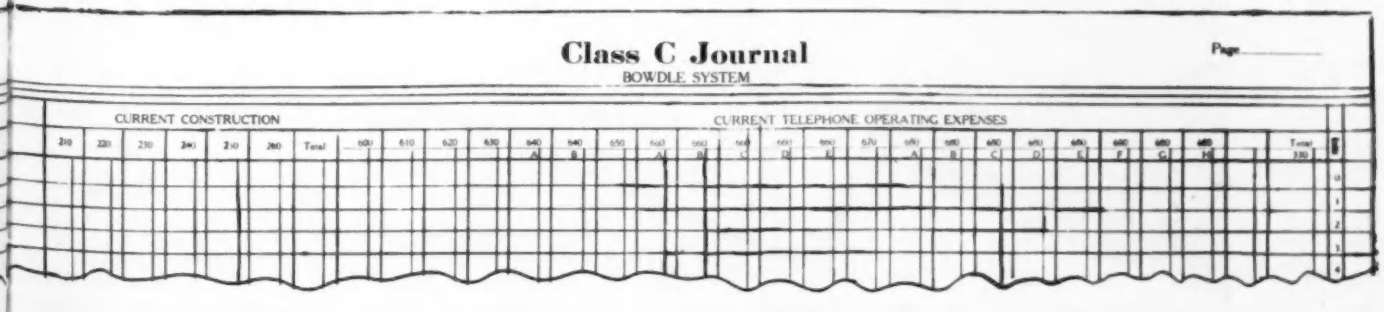
In general there are three distinctions made in handling plant accounts; namely, capital or construction accounts, renewals due to depreciation and operating expense.

According to the theories of accounting a capital account is an expense incurred in order to increase revenue beyond the point which would be reached if the expense were not incurred. Consequently we find that all new construction, such as new wire or cable leads, new station installations, new switchboard installations and the like which have never existed before in the plant under consideration, must be classified as capital or construction accounts and must not be confused with repairs or renewals which do not add to the original cost of the plant as such. These items of expense are classified as new land or buildings, new wire plant (aerial or underground as the case may be), new equipment (station or central office), new furniture or fixtures, or new equipment of a general nature such as an additional new truck or post hole digger. The distribution of these expenses is coded and placed upon vouchers for transcription to the cash journal and subsequently to the general ledger.

Any corporation and especially a public utility is legally entitled to set aside periodically a sum from its receipts to care for replacements due to depreciation. Experience has proved that a telephone property has rather well defined age limits, which when they are reached make necessary a replacement or renewal of the plant. Some corporations give the matter very detailed study and set up several reserve funds for depreciation of the various classes of equipment involved, some of which are shorter lived than others. However, it is the usual practice to consider depreciation in the aggregate rather than dividing it as has been mentioned. The average life of a plant has been rather accurately determined and the cost of replacing it may be accumulated over the period of its life so that when replacements become necessary the company will not be embarrassed by lack of funds to do the work. Such expense as the rebuilding of existing lines, the replacement of equipment due to wear or obsolescence, the purchase of a new truck to replace one already in use or any similar expense should be accounted as renewal due to depreciation and not as actual operating expense.

Operating expense as such includes all items such as labor for repair or maintenance work, the purchase of very short lived and inexpensive repair parts, such as transmitters, receivers, cord, small amounts of wire for repair purposes and the like. It does not include items of greater value or longer life such as a car load of poles or a section of switchboard.

Great care must be taken and a thorough knowledge of the principles involved is necessary in order to show the true condition of a company. An expense im-



Puttin te CHRISTMAS T

Life is complete in the active teens and twenties . . . so much to see and do and dream about! Your daughter will be grateful for a telephone in her room. It makes the room so completely and automatically hers . . . enables her to make dates and exchange confidences with full privacy. And don't forget ours!

"DAD HAD MY ROOM DONE OVER . . . AND GAVE ME A

TELEPHONE FOR CHRISTMAS!"

Telephones make pleasing presents to active sons and daughters

You can make this Christmas memorable for the younger generation in your home by providing them with personal telephones. Sons and daughters these days are modern, capable, businesslike. They have interests and obligations of their own. They'll welcome the courtesy and convenience of telephones in their rooms—and enjoy life *more*.

No need to neglect the rest of the household, though! Mother could use a telephone in her boudoir, or on her writing desk, a dozen times a day. Dad deserves one in his den beside the easy chair. Cook can stay close to her busy oven, with a telephone in the kitchen. Fact is, *all* the family will find living so much easier—if they have *enough* telephones!

Why not arrange to have this time-saving, step-saving convenience in your home by Christmas? The local telephone company will advise you on the best type of equipment for your individual requirement. Just call the Business Office—now.

No need to interrupt interesting games on a cozy evening with a telephone on the wall of the recreation room!

The swimpool is a pleasant place in winter. A convenient telephone will add to your family's enjoyment of it.

telephones under the TREE . . .

FOR THE first eleven months of this year, full-page advertisements have appeared regularly in national class magazines, stressing the comfort and convenience of the home that has *enough* telephones. They have illustrated convenience photographically, explained its moderate cost, and offered the assistance of the local telephone company in planning it. Many a home owner has read, and pondered, and acted.

In December, this campaign features the advertisement opposite, which directly and definitely suggests telephones as Christmas gifts—particularly acceptable to busy, active young people, but equally welcome to all the family. Appropriate locations are listed and pictured and the time-saving, step-saving features emphasized.

Few gifts are as practical and pleasurable as a personal telephone. This advertisement should help to put ribbon-wreathed telephones under Christmas trees throughout the territories served by Bell and connecting companies.

Advertisement of the American Telephone and Telegraph Company

properly classified may, if sufficiently large, affect the financial statement of the corporation and show a surplus where there should be a deficit or vise versa.

It might be well at this time to discuss briefly still another aspect of plant accounting which sometimes proves difficult, that being the matter of retirement and salvage of plant removed or replaced. If, for example, an aerial cable lead is replaced by an underground lead the aerial lead has in many cases considerable value either for future use or as salvage or junk. In such a case the original value of the retired plant items must be deducted from the plant value but at the same time the depreciated value may be added to the stores account if the materials are not immediately reused, while the difference between the original value and the depreciated value must be charged against the reserve for depreciation which has been mentioned in a previous paragraph.

A different form is used for Class A. and B. companies

FINANCIAL STATEMENT

for Class C companies.

Of _____ TELEPHONE COMPANY

_____ at the close of _____ 19____

Form F-11—Bookkeeping System, F. A. Bourdo, Cerro Gordo, Ill.

GENERAL BALANCE SHEET.

	ASSETS			LIABILITIES		
201	Fixed Capital Installed Prior to 19			160 Common Stock		
202	Intangible Capital			160 Preferred Stock		
210	Land $ Buildings $			160 Proprietors' Investment		
220	Central Office Equipment			165 Funded Debt		
230	Station Equipment			170 Bills Payable—Notes		
240	Exchange Aerial Lines			175 Accounts Payable Miscellaneous		
240	Exchange Underground Lines					
250	Toll Lines			158-B Audited Vouchers		
260	General Equipment			158-B Pay Roll		
261	Office Furniture and Fixtures			Wages Due Employees		
270	Undistributed Construction Expense			Officers' and Directors' Salaries		
280	Plant Purchased			159-B Subscribers' Deposits		
	Total					
185	Reserve for Accrued Depreciation—Cr. (Enter in red)					
	Total					
105	Miscellaneous Investments					
110	Investment Securities					
	Petty Cash					
115	Cash: Office $ Bank $			196-B Taxes Accrued		
120	Bills Receivable—Notes			167-B Interest Accrued—Bonds		
125	Subscribers' Rental Accounts			167-B Interest Accrued—Notes		
				167-B Dividends Accrued		
125	Subscribers' Toll Accounts			180 Accrued Liabilities Not Due		
				190 Other Credit Accounts		
130	Miscellaneous Accounts Receivable					
135	Material and Supplies					
145	Prepayments					
124	Unmatured Interest, Dividends and Rents Receivable					
150	Other Deposit Accounts					
118	Rent and Toll Suspense			185 Reserve for Accrued Depreciation		
	Treasury Stock			Corporate Deficit to 19 (Enter in red)		
	Bond Discount			195 Corporate Surplus to 19		
				Current Surplus Months		
				Current Deficit Months (Enter in red)		
				Net Surplus or Deficit		
	GRAND TOTAL			GRAND TOTAL		

	EXPENSE	Current Month	Months
600	Repairs of Wire Plant		
610	Repairs of Equipment		
620	Station Removals and Changes		
630	Depreciation of Plant and Equipt.		
640	Other Maintenance Expense		
	a—Land and Buildings		
	b—Auto, Tools, etc.		
650	Operators' Wages		
660	Traffic Expense		
	a—Cost of Power Purchased		
	b—Cost of Power Plant Labor		
	c—Cost of Renewing Batteries		
	d—Cost of Messenger Service		
	e—Other Traffic Expense		
670	General Office Salaries		
680	General Expense		
	a—Office Supplies and Expense		
	b—Directory Expense		
	c—Rents		
	d—Insurance		
	e—Law Expense		
	f—Accidents and Damage Costs		
	g—Advertising		
	h—Other General Expense		
330	Total Operating Expenses		
340	Other Operating Expenses		
350	Taxes Assignable to Operations		
360	Interest on Notes Payable		
360	Interest on Funded Debt		
370	Miscellaneous Charges to Income		
	Total		
	Dividends Paid from Surplus		
	Total		
	Surplus or Deficit (Deficit in red) (Carry to General Balance Sheet)		
	GRAND TOTAL		

	INCOME	Current Month	Months
500	Exchange Revenues		
500	Pay Station Revenues		
500	Service Station Revenues		
500	Toll Revenue Credited to Exchange		
510	Toll Rev. Credited to Toll Plant		
520	Miscellaneous Operating Rev.		
530	Licensee Revenue—Cr.		
540	Licensee Rev.—Dr. (Enter in red)		
300	Total Telephone Opr. Revenues		
310	Other Operating Revenues		
	Installation Revenue		
	Moves and Changes		
	Interest Revenue		
	Discount "		
320	Non-Operating Revenues		
	GRAND TOTAL		

_____ Auditor.

Combination of Revenue and Disbursements

From time to time in our discussion we have mentioned the cash journal, general ledger and financial statements. These forms are used to combine the revenues with the expenditures for the purpose of determining whether the company is operating at a profit or at a loss.

Many companies prefer to make journal entries each month and while this is not absolutely necessary it is a good business policy as it enables the managers to know exactly each month the financial condition of the company. If the expenditures are more than were anticipated or the revenues less, the policies for the next month may be formulated much more intelligently.

We do not believe it necessary to discuss in much detail the actual mechanism of the cash journal except to say that anyone familiar with double entry bookkeeping should have no difficulties in making the proper entries and obtaining correct balances. It is merely a summary of revenue and expense for the month (or quarter) properly classified.

The general ledger might be said to be a cumulation of each month's journal entries, properly classified and it furnishes a basis for the preparation of financial statements. All assets and liabilities are entered as debits and credits respectively together with revenues and expenditures.

The financial statement is a statement of the company's exact financial condition at a given date and it lists assets, liabilities, and expenses and revenues both for the current month (or quarter) and the cumulation of expense and revenue for the current year. The assets and liabilities must exactly balance as well as the expense and revenue, any surplus or deficit being accounted as profit or loss.

Centralized Accounting

Many of the smaller telephone companies feeling that the volume of business is too small to warrant the employment of a full time accountant or auditor, are at a loss to know how best to handle their accounting problems. The management often feels that it is desirable to know periodically the condition of the company, yet it is often impossible to obtain this information without employing an auditor to make an appraisal of the accounts and expenses. Many of these companies find it to their advantage to adopt one of the several centralized accounting plans now offered by competent public accountants who are familiar with the telephone industry.

This plan involves the handling of subscribers' accounts in the company's own business office. Periodically a balance sheet is prepared showing all accounts receivable together with a record of all collections made within the period with a

statement of accounts yet unpaid at the end of the period. This balance sheet together with a record of all expenses, shown on vouchers, and where it is convenient, a copy of the company's bank statement, is sent to the accountant who makes all journal and ledger entries and returns the data with a financial statement. Some accountants assume the responsibility for making all reports to the various public service commissions and tax commissions which are necessary from time to time. This service is rendered at a cost much less than the salary of even a very mediocre bookkeeper and its advantages are quite obvious. The accountant from his varied experience is often in a position to act in an advisory capacity in many of the questions which are apt to present themselves to the management and his knowledge of many of the legal aspects is at the service of his clients. He is in a position to give expert advice and testimony in rate cases where his services are often invaluable.

In conclusion the fact might be mentioned that there are many items which have not been discussed and which are not strictly accounting problems. For example, the data that is useful in compiling statistics on plant matters, time sheets, material reports, order blanks, station gain or loss reports, work orders and many other reports of this nature which are incidental to the efficient operation of a telephone plant. It is felt that the application of these forms and reports varies too much to permit a general discussion of them. Some companies use comparatively few of them while others accumulate a great mass of data sometimes to the extent that it becomes cumbersome. It is largely up to the judgment of the management in each individual case to determine how complete his data shall be and one manager may feel that he requires certain information which another may feel totally unnecessary.

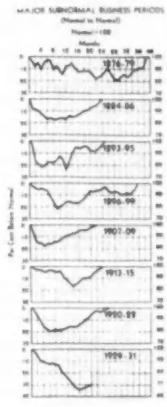
In this article the main points about telephone accounting have been discussed and we hope that some of the questions which may have arisen have been satisfactorily explained.

CHART SHOWS SUBNORMAL BUSINESS PERIODS

The interesting series of charts reproduced here were submitted by a telephone engineer named J. K. Johnston, whose desire it is to convince others that the worst of the depression is definitely over.

Mr. Johnson shows eight separate charts, each of which is concerned with a separate business upheaval in the United States. A careful comparison of these eight charts reveals many interesting facts.

One of these noticeable facts is that the longest period of depression in history lasted 40 months, while the shortest was 22 months. Another interesting fact revealed by these charts is that though it may have required from 24 to 40 months for business to climb back to normal, during the last several months



in each case, the trend was definitely upward.

It is also plainly seen that for the current depression, the line of the chart fell further than in any of the other charts, indicating that perhaps this really was the "worst depression in history." However, it is necessary to take into consideration the fact that probably the inflated prices of 1928 and 1929 should not be considered as "normal," since they were the highest in history; and that it is very possible that it may be years—not months—before such an inflated "normal" is reached again.

However, the important indication of the chart is that the present trend is definitely upward, and has been for several months. There may be small setbacks in the near future, just as there has been in times of previous depressions. However, it is noticeable that once the chart line starts working up, it isn't easily discouraged, and keeps on working up and farther up. Though it may be more than 40 months from the time of the first of the depression, before the 1929 "normal" is reached, it is only logical to suppose that reasonable and normal "normal" will have been achieved long before then.

HIGH ENGINEERING HONOR GOES TO DR. PUPIN

The John Fritz Gold Medal, highest of American engineering honors, has been awarded for 1932 to Dr. Michael I. Pupin of Columbia University for his achievements as "scientist, engineer, author, inventor of the tuning of oscillating circuits and the loading of telephone circuits by inductance coils," it is announced.

The award, which was unanimous, was made by a board representing the four national societies of civil, mining and metallurgical, mechanical, and electrical engineers, having a membership of more than 60,000.

Dr. Pupin is professor of electro-mechanics and director of the Phoenix Research laboratory at Columbia. Among engineers and scientists he is widely known for his researches and inventions in connection with long distance telephone lines, and for his advanced work in the passage of electricity through gases, electrical resonance, electrical wave transmission over long conductors, and other scientific subjects. Among his best known writings is an autobiography, "From Immigrant to Inventor."

He was born a Serb in a province of Hungary, October 4, 1858. He came to America as a boy and after many courageous struggles won an opportunity for an education. He was graduated from Columbia in 1883, studied at the University of Berlin, and received the degree of Doctor of Philosophy in 1889. He is a Doctor of Science of Columbia and Princeton Universities, and a Doctor of Laws of Johns-Hopkins University, New York University, Muhlenberg College and other institutions.

Dr. Pupin is a past president of both the American Institute of Electrical Engineers and the American Association for the Advancement of Science. He is a member of the National Academy of Sciences, the New York Academy of Sciences, the American Philosophical Society, the American Physical Society and other learned bodies, and a past chairman of the Engineering Foundation.

PIONEER IN TELEPHONE INDUSTRY DIES

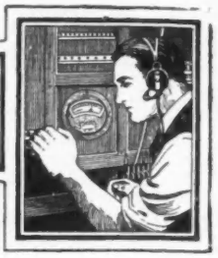
Dr. Edwin Fancher of Middletown, N. Y., president of the Orange County Telephone company for twenty-three years, died November 22 of pneumonia. He was 71 years old.

Although he was graduated from the Boston College of Homeopathy in 1882 and practiced medicine until 1912, Dr. Fancher became interested in the telephone in 1876 when it was first exhibited by Alexander Graham Bell at the Centennial Exposition in Philadelphia. He was influential in organizing the Orange County Telephone company in 1895, together with a group largely composed of doctors and dentists. Dr. Fancher, from the earliest days, believed the telephone indispensable to a man in his profession.

Dr. Fancher bought the controlling interest in the Orange County company in 1908, and in 1912 retired entirely from the practice of medicine, in order to devote more time to the telephone business. To the Middletown public, Dr. Fancher for many years was a personification of the telephone industry. He is survived by his son, Frank Dane Fancher, general manager and treasurer of the telephone company, three brothers, one sister, and five grandchildren.

THE TECHNICAL CLEARING HOUSE

B. C. BURDEN, Editor



Operator Efficiency

Q. What is the average length of time required to train a student operator to full efficiency as compared to old operators?

A. Data compiled by one operating company shows that an operator starting to work in a medium sized office should have an efficiency of 56% at the end of the first month, 74% at the end of the second month, and 81% at the end of the third month, and by the end of ten months should be 100% efficient. This data was compiled from observations made in connection with a large number of operators. Some companies estimate that it costs $1,000.00 to lose an operator. An efficient operator should be able to handle approximately 230 calls per hour for several hours without tiring.

Plug Maintenance

Q. Should an abrasive be used when polishing switchboard plugs or is there danger of removing too much metal by this method?

A. It is customary to use a mild abrasive and fairly heavy pressure with low polishing speed when maintaining switchboard plugs. The usual method consists of wrapping a single turn of sleeving around the plugs, applying a little abrasive compound and working the two ends of the sleeving back and forth so as to polish all sides of the plug. The plugs should be wiped with a clean cloth after polishing to insure removing excess polishing compound.

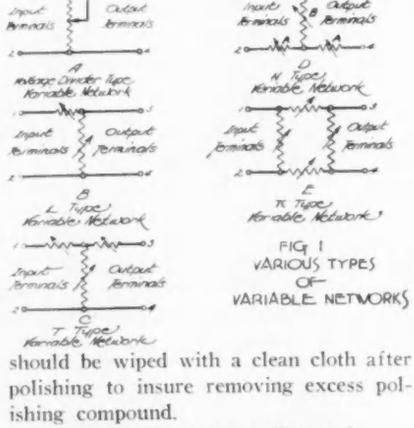


FIG. 1
VARIOUS TYPES OF VARIABLE NETWORKS

Variable Resistance Networks

Q. Please explain what is meant by the term "variable resistance network."

A. The term "variable resistance network" refers to an arrangement of resistances, usually non-inductive and having two input and two output terminals. In connection with telephone and sound projection work they are used primarily for volume control. There are five principal types of resistance networks used in connection with volume control work. These are shown schematically in Fig. 1. Variable type networks are shown although for many purposes the fixed loss type is used.

The simplest of the variable networks is shown in A of Fig. 1. This network is known as the voltage divider or potentiometer type. It will be noticed that the volume is varied by means of the variable arm connected to the output circuit. A simple control is thus obtained, however such a network has the disadvantage that the impedance of both input and output sides of the network vary as the variable arm is changed. Where the output terminals are connected to a high impedance source such as the grid circuit of a vacuum tube, this type network is particularly suitable. Illustration B of Fig. 1 shows a modified form of the voltage dividing type network.

This type network, which is known as an L section is so arranged that the impedance looking into the input terminals will always be constant for a given impedance connected across the output terminals. The impedance across the output terminals however varies with the variable arm setting. Illustration C of Fig. 1 shows a T section network. This type network receives considerable use in the telephone field as well as in sound projection work where a constant impedance variable loss network is required.

The network is designed so that the impedance of the input and output terminals is the same regardless of the setting of the variable arm. This network is often referred to as the "unbalanced network" for the reason that it would introduce a series unbalance if inserted in a telephone line due to the fact that series resistances exist in only one side of the circuit. Illustration D of Fig. 1 shows the H or balanced type network. This network is the most common type of network used in connection with telephone transmission circuits. Like the T networks, it can be designed to have constant impedence at both input and output terminals for any setting of the variable arm.

It offers an advantage over the T network in that equal resistances are inserted in both sides of the line, hence, it is of the balanced type and can be used in connection with any telephone circuit without danger of upsetting the balance. Illustration E shows what is known as the π network. This type network is used to some extent in telephone work and has similar characteristics to the H or T networks, that is, it presents a constant impedance at both input and output terminals regardless of the setting of the variable arms.

It is somewhat more difficult to design, hence, is not used as much as the H or T type networks. In working with networks there are two factors which must be considered. These are the characteristic impedance of the input and output sides of the network respectively, and the loss in decibels which the network introduces when inserted in a circuit of given impedance.

The resistance values for an H type network are found by the following two equations:

$$A = Z\left(\frac{1-n}{2\,(1+n)}\right)$$

$$B = Z\left(\frac{2\,n}{1-n^2}\right)$$

As follows: Where A equals resistance of the A arm.

B equals resistance of the B arm.

N equals the desired ratio between input and output current.

Z equals the characteristic impedance of the circuit in which the network will be used.

To illustrate the use of these equations in designing resistance networks the computation of a 1 decibel-600 ohm network of the H type is shown below:

1 decibel = 0.891 current ratio (this is obtained from decibel or current ratio table), then

$$A = 600\left(\frac{1-0.891}{2\,(1+0.891}\right) = 17.28 \text{ ohms}$$

$$B = 600\left(\frac{2\times 0.891}{1-0.891}\right) = 5.190 \text{ ohms}$$

BEG PARDON

Through an oversight the article entitled "Methods for Locating Resistance Faults," which appeared in the October and November issues of TELEPHONE ENGINEER, did not carry the following credit line:

Bell System Technical Journal, July, 1931, "Bridge Methods for Locating Resistance Faults on Cable Wires," by T. C. Henneberger and P. G. Edwards.

News From the Field

Improvements are being made in the telephone exchange at Amboy, Ill.

The Fairbury city council, Fairbury, Nebr., has voted to accept the proposition of the Lincoln Telephone and Telegraph company, for joint construction of telephone and electric poles in the city when new lines are installed. Under the agreement, where possible, the city and company will put their lines on the same poles.

The Farmers Telephone company has invested $5,000 in improvements to the telephone exchange at Scribner, Nebr.

Fifty managers and employees of telephone companies in the First district of Kansas met at Holton recently for a regional conference.

The Northwestern Bell Telephone company will build a new three-story fireproof building at Norfolk, Nebr., to house the local and district exchanges.

Improvements will be made on the Wapakoneta (Ohio) telephone company exchange during the winter months, including the replacement of all cable with new cable.

A new modern switchboard has been installed at Marseilles, Ill., by the Marseilles Telephone company.

Net income of Bell Telephone company of Pennsylvania for nine months ending September 30, 1931, was $8,466,432 after depreciation, federal taxes, interest, etc., against $7,882,509 in first nine months of 1930.

International Telephone & Telegraph company is reported to be negotiating for control of the French Cable company, which owns three cables between this country and France and some of the French colonies.

Additional switchboard facilities are being installed in the Carroll, Iowa, office of the Northwestern Bell Telephone company. One hundred and forty subscribers' lines are being added.

The Illinois-Bell Telephone company and ten other companies have filed schedules with the Illinois commerce commission for adjustment of charges for service and connection and for moving telephones within a subscriber's premises. The new reduced charges will affect about six hundred Illinois cities.

Mortimer E. Cooley, Dean Emeritus of the University of Michigan College of Engineering, and Henry E. Riggs, Honorary Professor of Civil Engineering, have been requested by the Public Utilities commission to review the work done so far in the valuation of the Michigan Bell Telephone company, which is being determined as a basis on which to fix state phone rates.

The Kittaning Telephone company of Kittanning, Pa., has purchased a Lamp Signal Magneto switchboard from the Stromberg-Carlson Telephone Manufacturing company, for its Rural Valley, Pa., exchange. The new board will be equipped with 100 lines.

Articles of incorporation have been filed with the secretary of the state of South Dakota for the Athol Telephone company, Athol S. D. The purpose of this company is to purchase and operate a portion of the rural lines of the Athol Mutual Telephone company.

American Telephone & Telegraph company has extended its overseas service to the island of Sumatra. The circuit will be in operation during the business day.

Construction will begin shortly on an extensive addition to the Woodland central office building of the Bell Telephone company of Pennsylvania in Philadelphia. The extension will represent a large investment and will provide 17,400 additional square feet of floor space to the existing structure.

Transatlantic telephone service from the United States to Rumania was formally opened at 10 o'clock the morning of November 9, when the Minister of Foreign Affairs of Rumania, Prince Ghika, spoke to Secretary of State Stimson.

Representatives of the United Telephone company, representing a good sized territory in central Missouri, met November 17th at Tipton, Mo., to discuss telephone sales.

The Liberty Telephone Utilities company soon is to pass into oblivion and in its place will be the Indiana Associated Telephone corporation. Change in name does not involve change of ownership, but has been done in order that all of the 30 exchanges under the Indiana Associated Telephone corporation will be operated under the same name.

The New Jersey Bell Telephone company has guaranteed continued employment during the depression period to its 14,000 employes, according to a letter signed by Vice-president G. W. McRae and directed to all offices in the state.

The Assumption Mutual Telephone company, Assumption, Ill., is making rapid headway on the installation of its new telephone system, which it is expected will be completed by Christmas.

The telephone exchange in Osborne, Kans., has been moved into a new, completely modern building.

The Southern Telephone and Telegraph company is completing a number of improvements in the exchange at Mt. Sterling, Ky.

Office of the Illinois Consolidated Telephone company, Hillsboro, Ill., has been moved to new quarters in a completely remodeled building which has been furnished with new and modern telephone equipment.

An official opening of the new improved switchboard of the Illinois Valley Telephone company at Roseville, Ill., took place recently. The company has put up some new cable in addition to installing the new switchboard in the telephone office which itself was newly built last summer to house the exchange.

Southwest Missouri Telephone company has been granted permission by the public service commission of Missouri to purchase exchanges at Qulin, Puxico, Patton, Marquand, Marble Hill, Fisk and Advance from the Scotia Telephone company, with headquarters at St. Louis. The purchase price was $60,000.

Southeast Missouri Telephone company has moved its Sikeston, Mo., exchange into new quarters. The new office, formerly a bungalow, has been improved to the extent of $3,200.

Work of building the Yuma Joes toll line in Arizona by the Mountain State Telephone company has been started.

Reports of 105 telephone companies to the Interstate Commerce commission show September net operating income of $23,146,032, against $23,000,585 in September, 1930. The nine months' net was $208,159,263, against $202,695,966 in the same period last year.

St. Marys Telephone company, St. Marys, Ohio, has moved from its old offices to a new modern fireproof structure built by the company. A cut-over to the new equipment will not be made until January 15.

United Telephone company has had a crew of ten men at work recently rebuilding lines out of Oberlin, Kans.

Telephone Activities in Foreign Countries

Dispatches from Abroad Keep Telephone Men in United States Constantly Informed Concerning Telephony of the World; Domestic Telephone Problems Oftentimes Can Be at Least Partially Solved by Watching the Outcome of Experiments Made Elsewhere

Telephone Systems Scarce in the Azores

St. Michael's, with an area of approximately 300 square miles, is the only island in the Azorean Archipelago on which telephone service is maintained. Ponta Delgada, the principal city in the Azores, and Vila Franca do Campo, the second leading communal center on the island, are equipped with exchanges, while several lesser villages are served with public telephones. These public telephones are usually installed in the village post office, and nearly all of them are connected to the wires of the island's telegraph system. Both exchanges, as well as the public telephones, are owned by the Portuguese Government and controlled by the General Telephone and Telegraph Service Administration (Administracao Geral dos Correios e Telegrafos), under the direction of the Minister of Communications at Lisbon.

Improved Communications Between Penang and the Mainland

The island of Penang lies some five miles off the west coast of the Malay Peninsula and is about 15 miles long by 9 miles wide. The progress of intercommunication facilities during the past several years has been marked. In 1925 there was laid a 16-wire continuously-loaded telephone cable, between Georgetown and the mainland, to augment the long-distance telephonic facilities then existing. The telephone and telegraph traffic developed rapidly, necessitating the laying of further cables, both telegraph and telephone. This work has been completed recently. Whereas the 1925 cable had 16 conductors, the new telegraph cable has 8, and the new telephone cable, 64 conductors. The specification of the former is: Eight conductors, 107 lb. per mile, paper insulated, copper tape screened, double lead alloy sheathed, brass taped, double wire armored, with external diameter 2.54 inches; and the latter—8 pairs conductors, 165 lb. per mile; 16 pairs, 45 lbs. per mile; 12 pairs, 20 lb. per mile; paper insulated, taped, reinforced with a heliz composed of two steel wires double lead alloy sheathed, brass taped, double wire armored. The length laid under the sea is 3½ miles in both cases, the total weight of cable being 80 tons and 122 tons respectively. These cables, and the earlier ones, were manufactured, supplied and laid by Siemens Bros. and Co., Ltd., Woolwich.

Propose Telephone Service Between Tasmania and the Mainland

In its report on telephone communication between Tasmania and the mainland, which has been tabled in the House of Representatives, the public works committee stated that undisclosed benefits which would result from this service would tend to increase revenue in indirect ways. The project was an even better financial proposition that it now appeared. When funds could be conveniently made available, therefore, the committee was unanimous in recommending that a submarine cable be laid from Lorne, via King Island, to Stanley, to connect the systems of Tasmania and the mainland. The cost would be £180,800.

British International Traffic for Year Ended March 31

The total number of inland trunk calls originated during the year ended March 31, 1931, was 121,669,598, representing an increase of 4,539,385, or 4 per cent, over the total for the previous twelve months. Outgoing international calls for the year numbered 545,037 and incoming international calls, 585,172, as compared with 535,977 and 581,831 respectively for the year 1929-30.

Damage to Telephone Cables in Siam

For many years most tropical countries have been bothered with the depredations to telephone and telegraph cables caused by insects. In Siam, it was formerly thought that the culprit was the "termite," or white ant, but recent investigations have been made in this connection by Major W. R. S. Ladell, of the Division of Agricultural Science, and it has been pretty definitely proved that the insect responsible is the carpenter bee.

The most effective remedy against these damages is to place a thin armor of brass round the lead cable. However, this is an expensive undertaking, and in lieu of this experiments are being carried on whereby the cable is coated with a mixture of equal parts of tar and sand. It is believed that this gritty substance will prove a deterrent to the carpenter bee.

Open Telephone Service Between Buenos Aires and Mendoza

The Cia. Argentina de Telefonos has recently completed telephone lines which permit the connecting of Buenos Aires with Mendoza, Argentina, and the service is now opened to the public. The inter-connection of the company's telephone exchange in Mendoza, San Luis, Cordoba, Santa Fe and the Territory of the Pampa now enables 8,000 subscribers in the interior to communicate directly with the federal capital. The line passes through six automatic exchanges located at Mendoza, San Luis, Villa Mercedez, Laboullaye, Rufino and Venado Tuerto. The service with Mendoza is made from Buenos Aires through the Cia. Telegrafice Telefonica.

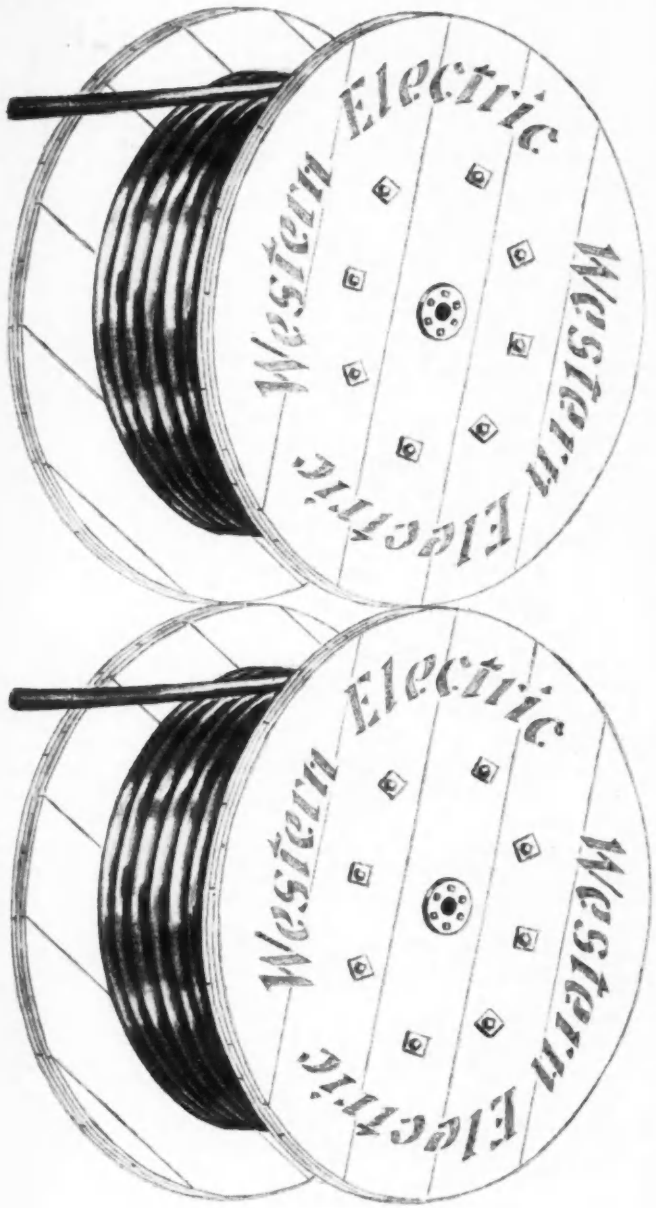
Radiotelephone Service Between Colombia and Chile

Radiotelephone communication with Chile was inaugurated by All America Cables, Inc., on August 1, in accordance with the contracts for this service signed with the Government on June 3 and 24, 1929.

Swedish Telephone Administration Celebrates Anniversary

The Royal Swedish Telephone administration celebrated the fiftieth anniversary of the opening of public state telephones in Sweden on September 1, 1931. During the last fifty years Sweden has reached a dominant position in the fields of telephone manufacturing and telephonic communication. Telephones have been made in Sweden since 1877.

There are 534,000 telephones, or approximately one per 11 inhabitants, and more than 4,000 telephone exchanges in Sweden at present, according to Count H. A. Hamilton, director general of the Royal Swedish Telephone administration. The total length of telephone lines approximates 966,000 kilometers and the total amount of capital invested is in the neighborhood of 300,000,000 crowns. During the past year 791,000,000 telephone calls, approximately 131 calls per capita, were registered. The technical development of the telephone system in Sweden has been, and is going forward very rapidly, especially with regard to the changing of the exchanges from manual to automatic operation. A large part of the Stockholm telephonic system is automatic and exchanges of this kind also have been installed in several other cities and towns in Sweden. The ultimate aim is to make the entire telephone network in Sweden automatic.



CABLE...

and 60,000 other items

The guarantee of quality implied by the name Western Electric on Western Electric lead-covered cable has long been recognized by the telephone industry. But equally important is the additional endorsement of Graybar—an endorsement that insures the quality of 60,000 electrical items.

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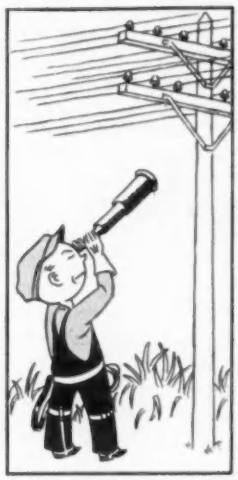
WHICH
would You rather do?



. . . locate two or three intermittent connections?

. . . . or make every joint in the system permanently secure?

YOUR trouble-shooters can spend days, weeks, even a month or more locating a couple of trouble-making mechanical joints. And its a proven fact that the cost of this process is actually more than it would require to rig up a traveling platform and Kester-Solder every joint in the system!

Maintenance costs that have been higher than a kite will drop like a plummet when you start *soldering*. Kester is absolutely safe and certain . . . and speedy, too! Far more convenient than separate-flux solders, because it carries its flux inside itself. If you've got one soldering problem, or a dozen, write our Industrial Development Department and have them solved. Get a free sample . . . or buy 1, 5 or 20lb. spools from your jobber. We design special fluxes for specific needs.

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Missourians Call Telephone a Necessity

Telephone Employes Must Maintain Idea of Value of Telephone in Minds of Public, MacKinnon Tells Delegates to Missouri Telephone Association Convention Held in Kansas City, in His Address; Further Discussions Were Along Lines of Selling Telephone Service

Emphasis of the telephone as a necessity, and the importance of advertising and selling it as such, proved to be the keynote of the annual conference of the Missouri Telephone association held at the Hotel President, Kansas City, November 11 and 12.

Houck McHenry of Jefferson City was re-elected president of the association, and the remainder of the officers were re-elected with the exception of W. R. Journey, Citizens Telephone company, Higginsville, who was chosen second vice-president to succeed F. M. Browne.

The other officers are: A. M. Benedict, Richards, first vice-president; G. W. Schweer, Clinton, third vice-president; W. E. Carlson, Rolla, fourth vice-president; and W. R. Hedrick, Jefferson City, secretary-treasurer.

The executive committee includes: C. A. Ulfers, Kansas City; S. D. Thompson, Cameron; Ranford Dunlap, Kansas City; S. T. Neill, Clinton; C. W. Boutin, Cape Girardeau; E. F. Carter, Columbia; H. C. Todd, Marysville; F. M. Browne, Clarence, and C. A. Vedder, St. Louis. Two new members elected to the executive committee were Ranford Dunlap, succeeding V. E. Chaney, and F. M. Browne, succeeding M. L. Golladay, Holden.

The opening conference address was given by F. B. MacKinnon of Chicago, president, United States Independent Telephone association. President MacKinnon said, "The telephone companies are the leaders in the movement of climbing out of the depression."

In amplifying this statement he said that although most industries have been affected in some way in the last decade by changes in the habits of the people, use of the telephone has been constantly increasing and there seems to be nothing in the future that will interfere with its growth. "If we do not maintain the idea of the value of telephone service in the minds of the public," Mr. MacKinnon said, "it is our own fault. There is not a man who can afford to do without a telephone in his own home and you know it."

Mr. MacKinnon said the results of sales campaigns conducted by telephone companies have shown that if the employes work energetically and intelligently, the company can not only maintain its list of subscribers, but actually increase it. He also said that it had been discovered that subscribers gained in this manner were more likely to retain their telephones than those who ordered them four or five years ago, over the counter.

"The telephone industry stands in a most enviable position," he said. "If there is a company not maintaining its position, it is that company's own fault." He suggested that companies talk about the value of service and not the cost. As an illustration he cited the selling of advertising for which the salesman talks of the value of advertising, not of the high cost of printing and paper.

"We in the telephone business have been very delinquent in not advocating and advertising telephone service value," he said.

Following President MacKinnon's message, President McHenry, who was presiding, called upon A. L. Stadermann, Terre Haute, Ind., chief engineer, Citizens Independent Telephone company, who gave an address called "Good Service Sells Service."

Mr. Staderman said that since the purpose of any commercial program is to improve the financial condition of the company, yet it is important to know just what business should be striven for, as there are always some unprofitable branches.

He said that the rate structure therefore was important.

"It is a very common mistake for instance, of the small companies to make too great a difference between individual service and party-line service. This really puts the party-line service in an unprofitable class and encouragement of it naturally results in financial difficulties.

"After all," Mr. Staderman continued, "the subscriber agrees to the amount he pays according to the value of his service and not according to the cost which he causes." He declared that today the most important problem of the average telephone company is that of furnishing rural service at a remunerative rate and yet not a prohibitive one which would result in loss of subscribers.

The next speaker called upon was H. M. Cox, Kansas City, Mo., commercial engineer, Telephone Bond & Share company, who discussed the employes' selling service plan and the products sold.

"The one big job," Mr. Cox said, "that telephone companies have before them at all times, is the continued education of the public and its subscribers as to the value of telephone service." He said it was futile to change rates in these times, in an attempt to increase companies' income. He said rather should employes be thoroughly trained so that they will not overlook any opportunities to emphasize the value to the public of the telephone.

Ways of improving rural service and thereby increasing income were then discussed. Mr. Cox said it had been his experience that the introduction and establishment of a higher grade of telephone service not only improves the service but increases the connected station loads and the companies' revenues.

As a result of the study of sales methods used by his company, Mr. Cox said he believed that telephone companies should be constantly selling their rates and service if they hope at all times to have a satisfied list of subscribers. He voiced the opinion that campaigns should be used only as a final wind-up to a steady siege of selling by the employes.

Foster McHenry of Jefferson City, secretary, Capital City Telephone company, was also among the speakers. Mr. McHenry spoke on the actual results of a recent sales campaign conducted by his company.

The Capital City company serves Jefferson City, Mo., having a population of about 21,000. One exchange is operated with nearly 5,400 stations. When the campaign was started the modest quota of 100 additional telephones was selected, and the three departments of the company, maintenance, traffic, and commercial, were to constitute competing teams The campaign lasted for 30 days, during which a total of 536 sales were made, a gross increase of 5.9 per cent. At the present time the company is conducting another campaign, and at the time of the convention had gained 79 new stations in nine days.

Mr. McHenry said the cost of such a campaign was not high; that the banquet for the first one, at which the campaign was officially inaugurated, cost $83.60, and that there was paid to employes $181.86 since they were allowed 35 cents out of every dollar of new business brought in.

During the convention, conferences were held for the plant men and for the operators. The former was conducted by J. C. White, Clarence, plant supervisor Western Telephone Corpora-

Keeping an Eye on Millions of Dollars

THINK of the vast sums which have been collected on toll charges since 1894, when the first Calculagraph to serve American telephone companies began its work of counting up the minutes and excess minutes on the nation's toll boards. What a keen, watchful eye the Calculagraph must have kept on these millions of dollars, to serve so long and with such complete satisfaction.

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YOU BUY telephone batteries for just one purpose—to give satisfactory service for a long time. Short service means high cost—long service, low cost. Ray-O-Vac Telephone Batteries cost less because they deliver long service—more hours than most other cells. This is proved not only by competitive tests conducted in accordance with U. S. Government standards, but by users' records as well. Moreover, there's an appreciable saving in service costs. Standardize on the Ray-O-Vac Telephone Battery—the cell with the low service-hour cost.

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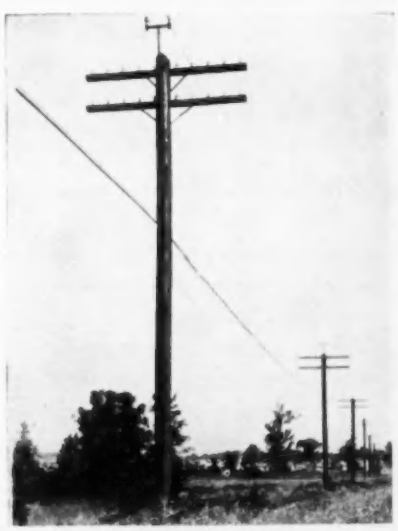

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Finney (P. O. Col. Park, O) Kansas City, Mo.
Salida, Colo. Denver, Colo. Superior, Wis.

tion of Missouri. The operators' conference was in charge of E. F. Carter, Columbia, general manager, Missouri Telephone company. Approximately 250 persons were in attendance at the convention.

NEW NAMES FOR MANUFACTURING AND SALES COMPANIES

Announcement has been made by Associated Telephone and Telegraph company of changes in names of three of its subsidiaries, which were effective December 1, 1931.

The name of Automatic Electric Inc., manufacturers of Strowger automatic systems, has been changed to Automatic Electric company, with general offices at 1033 West Van Buren street, as before. American Electric company, Inc., manufacturers and suppliers of manual telephone equipment and telephone construction material and supplies, etc., now becomes American Electric company. The latter organization recently moved into new and extensive manufacturing quarters at 6126 South LaSalle street.

Automatic Electric Sales company, Limited, is the new name for the export distributing company for the group, the former name being the Automatic Electric company, Limited. The address of this company, 1027 West Van Buren street, Chicago, remains the same.

These changes are the first steps in a program of harmonizing the corporate names of the various manufacturing and sales units of the Associated-General telephone group so as to more readily indicate the scope and functions of each company.

It is suggested that all telephone companies and others having dealings with any of these companies change their records accordingly, and that the new names be employed in forwarding correspondence, orders, remittances, etc.

IMPROVE TELEPHONE SERVICE

Officials of the Villisca Mutual Telephone company hope to have completed installation of the company's modern new switchboard by the last of the month so that all lines may be "cut in" from the old switchboard to the new.

Work of installing the new board is under way under direction of two experts from the Kellogg factory in Chicago where the switchboard was made to order for the Villisca company. A vast improvement in service is anticipated when the new switchboard goes into operation.

FIGHTING DECAY AND INSECT ATTACK ON POLES

(*Continued from page* 24.)

the interior of the wood, making it receptive to the preservative. The duration of the steaming period depends, of course, on the condition of the poles.

It is generally conceded that pressure creosoted poles have an average life of at least 25 to 30 years. There are many such poles in service that are much older. Most of these were treated when the wood-preserving industry was not as far advanced in the art of wood-preservation as it is today. Like other sciences, the science of timber treatment has advanced. The improved plant equipment in use today permits better regulation and more scientific control of the treating processes. Roofing, gaening, and boring are now done at the plants before treatment, thus precluding the necessity for breaking the treated shield by field cutting and framing.

The use of the full pressure creosoted southern pine pole by American utilities has increased by leaps and bounds. So late as 1918, only slightly more than 67,000 pressure treated poles were required. Six years later, viz., in 1924, the demands emanating from the different power and telephone companies were for nearly 900,000 poles. Three years later, 1,738,000 were required. For the year 1930, notwithstanding the fact that the total number of all species of poles had declined 2½ per cent from the number required the year previously, the use of full pressure treated poles had increased 21 per cent over the 1929 requirements. More than 2,400,000 southern pine poles were required in 1930, the last year for which statistics are as yet available.

NEED LUCKY NUMBER TO GET PHONE IN JAPAN

If a man draws a lucky number he may get a telephone in Japan within two or three years, according to Judge W. L. Crittenden, Oklahoma City, field representative, Oklahoma Utilities association, who has just returned from a two months' tour of the Orient. "All telephone, telegraph and cable facilities in Japan are owned by the government," he said.

"I heard of one gentleman in Tokyo," said Judge Crittenden, "who was not so lucky in the drawing. At the ripe age of 67 he applied to the government for an additional office telephone. The instrument was installed shortly after he had celebrated his 80th birthday. If a Japanese citizen is in a hurry for a telephone installation he knows that it is useless to apply to the government, but tries to locate a telephone through a broker or by advertising. I was told that a telephone for the business district of the capital through this method might cost as much as $1,200 and in a residence district $500 or less. The Japanese are not satisfied with their telephone service and recently an agitation was started demanding a reform, but the government functionaries instead of increasing the service started a campaign to discourage use of the telephone."

NEW YORK TELEPHONE CO. SPENDS $58,603,280

The expenditure of $563,350 for new construction throughout the state was authorized by the board of directors of the New York Telephone company at the regular monthly meeting held November 25, according to an announcement made today by J. S. McCulloh, president. This brings the total appropriated for this purpose during the first eleven months of the year to $58,603,280.

ELEMENTARY COURSE IN TELEPHONE PRACTICE

(*Continued from page* 21.)

Like poles repel.

Unlike poles attract.

This will be our first rule in magnetism, and must be remembered because it plays a big part in our telephone equipment.

We must remember then that magnets have a power of either attracting or repelling.

ASSOCIATED TELEPHONE GROSS AND NET UP

The Associated Telephone Utilities company and subsidiaries report consolidated earnings of $912,538 after all charges, excepting depreciation, for the quarter ended September 30, as compared with $821,411 in the same period of last year. Gross earnings for the period were $4,540,432, as compared with $4,018,038 in the like period of 1930.

For the twelve months ended September 30 earnings aggregated $3,444,408 before depreciation, as against $3,252,514 in the like period last year. Gross earnings, including subsidiaries acquired from date of acquisition, totaled $16,944,288, as against $15,162,401.

Comparisons of the consolidated income accounts for the quarter and the twelve months ended September 30, follow:

Quarter—	1931.	1930.
Gross earnings...	$ 4,450,431	$ 4,018,037
*Opr. earnings...	912,537	821,441
Prefd. dividends.	196,560	146,290
Bal. for com. and depreciation ...	715,977	675,120
12 months—		
Gross earnings...	16,944,287	15,162,401
*Opr. earnings...	3,441,478	3,252,513
*Total income...	3,444,408	3,252,513
Prefd. dividends.	643,066	584,671
Bal. for com. and depreciation ...	2,801,341	2,667,842

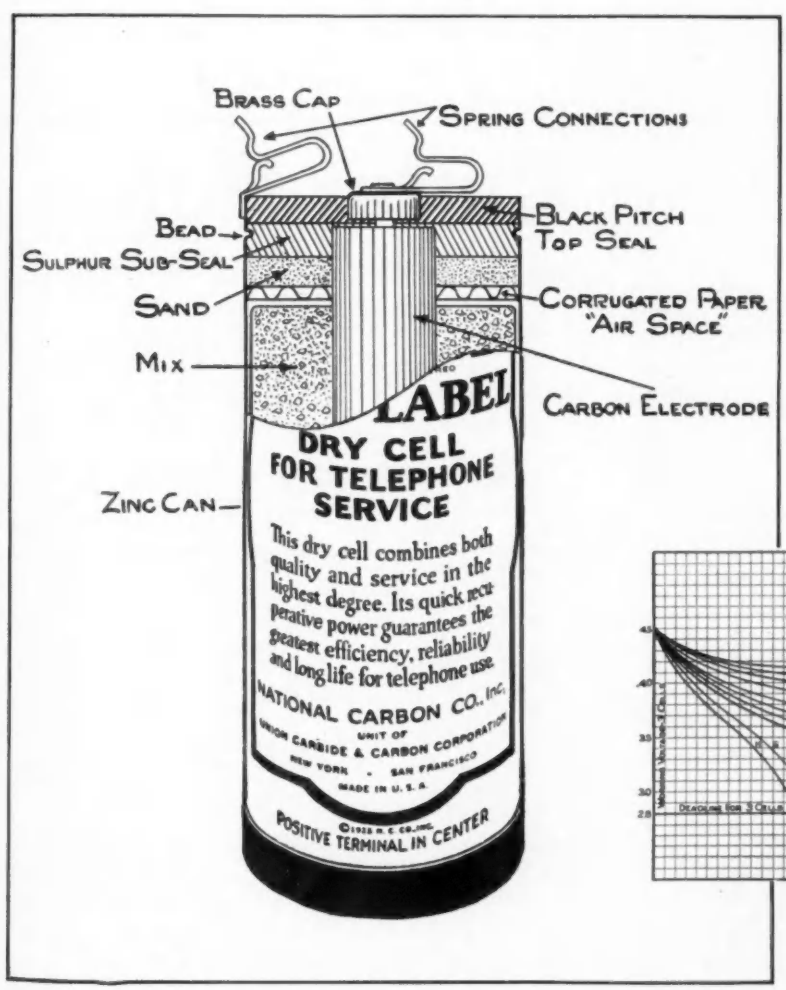
*Before depreciation.

★

"They always come back for more"

JUST like the telephone switchboard, the Columbia Gray Label Telephone Dry Cell is busy day and night. Its ceaseless activity is what makes it the ideal battery for telephone use. When the receiver hook is up, you get a healthy, quick response. When it is down, the battery immediately rebuilds most of the energy consumed.

There are no foreign ingredients that set up internal circuits and waste energy. The gauge of the zinc is thicker. The "bead" protects against bulging towards the top. Scientific construction, by manufacturers with more than thirty years' experience at battery making, makes Columbia Gray Label Dry Cells the universal choice for telephone use.


BRASS CAP
SPRING CONNECTIONS
BEAD
SULPHUR SUB-SEAL
SAND
MIX
BLACK PITCH TOP SEAL
CORRUGATED PAPER "AIR SPACE"
CARBON ELECTRODE
ZINC CAN
LABEL
DRY CELL FOR TELEPHONE SERVICE
This dry cell combines both quality and service in the highest degree. Its quick recuperative power guarantees the greatest efficiency, reliability and long life for telephone use.
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NEW YORK - SAN FRANCISCO
MADE IN U. S. A.
POSITIVE TERMINAL IN CENTER

NATIONAL CARBON CO., INC.

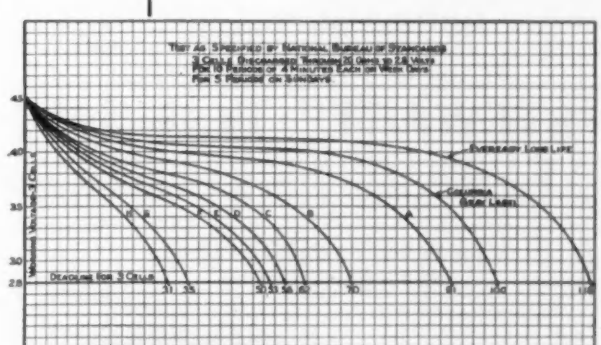
General Offices: **New York, N. Y.**

Branches: **Chicago Kansas City New York San Francisco**

Unit of Union Carbide UCC *and Carbon Corporation*

Columbia Telephone Batteries *–they last longer*

★



Day's life on Standard Light Intermittent Test is expressed in percentages based on Columbia Gray Label as 100%. *The Eveready Long Life battery shows* 118% *or plus service, but also carries a higher price.*

ACTIVITIES OF "B" SWITCHBOARD SUPERVISOR

(*Continued from page 25.*)

double wound and the secondary winding of 1000 ohms is used to prevent the No. 4 relay from releasing when the "B" supervisor removes her talking set from the talking jack. The No. 4 relay is held operated from No. 1 relay of the trunk jack sleeve. This is done so that a false recall cannot be made. Generally the supervisor disconnects first. The "B" supervisor's talking circuit is of the anti-side tone type. The secondary of this circuit is connected across the repeating coil on the "B" trunk side.

On the "B" trunk side of the repeating coil there is a circuit which is used to trip the ringing circuit of the "B" straight forward trunk in case the "B" operator sets or operates a ringing key before plugging into the supervisor's circuit. This condition would cause the "B" supervisor to get a ring in the ear if the ringing is not tripped. The No. 5 relay is an alternating current relay in series with a condenser connected at the mid-point of the repeating coil and which will only operate when ringing current is on the trunk circuit. With this relay operated the No. 6 relay operates and this relay places the impedance coil of 500 ohms across the trunk conductors, tripping the ringing of the "B" trunk.

When the ringing is tripped the No. 5 relay releases. The No. 6 relay releases and removes the impedance Coil No. 7. The supervision at the distant office through the "B" straight forward trunk will remain in a dark position so that the distant "A" operator will not be called in on the connection.

The "B" supervisor's plug circuit is connected on the opposite side of the repeating coil and the circuit is arranged so that the "B" supervisor may make busy tests on the local line multiple or trunk multiples. If the supervisor, when testing a multiple jack with the tip of the plug, encounters battery on the sleeve of any jack, she will obtain a click in her head receiver.

When the No. 8 splitting relay is normal a ground is on the 350 ohm non-inductive resistance coil to the tip mid-point of the repeating coil to the tip of the plug. This circuit is the busy test circuit.

Plugging the supervisor's plug circuit into the supervisor's trunk to the "A" board, the No. 8 relay operates and splits the "B" trunk jack circuit from the "B" supervisor's talking circuit. The No. 8 relay operates from the SL coil of the "A" trunk circuit.

The operation of No. 8 relay also removes the busy test ground from the 350 ohm non-inductive coil and places this coil across the condenser in the mid-point of the repeating coil. This operation places a closed circuit of coil and repeating coil across the tip and ring conductors of the plug and "A" trunk jack circuits, causing the regular line relay LR to operate. With the LR relay operated, the incoming line signal lights and the "A" operator plugs in and operates the C. O. R. relay, extinguishing the incoming signal. The "A" operator is at this time connected with the "B" supervisor.

The section signal pilot lamp lights when the section signal key is operated. Ground is placed on the signal lamp from the key and on the other side of the lamp is connected the No. 2 relay to battery. The single stroke signal bell operates at this time the same as the incoming "B" supervisor's call.

The section signal key is of the locking type and is restored to normal by the "B" supervisor upon her arrival at the calling section of the "B" board.

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Telephone and Switchboard Cords and Wire
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4727-31 Montrose Ave., Chicago
The Home of the Perfect Cord

LET US SEND YOU A BULLETIN COVERING THE FWD TRUCKS FOR PUBLIC UTILITY SERVICE
The Four Wheel Drive Auto Company
CLINTONVILLE, WISCONSIN

"STEWART" Test Set
Trade in your old test set on a New STEWART with Detector coil. Tells distance and direction to line trouble. Complete as shown in sketch for $36.00. Sent on trial. Write for literature.
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OTTAWA, ILLINOIS

Cedar Poles
Northern White Western Red
Plain or Treated Butts
Prompt Shipment from Minneapolis Yard.
T. M. Partridge Lumber Co.
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For Every Job
Dependable battery operation is imperative to uninterrupted telephone service.
Exides are dependable. Thirty-five years of service in the telephone industry have proven that. Dependable Exides assure a long life of satisfactory service.
DEPENDABLE EXIDE BATTERIES
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HEADQUARTERS

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STOP IN THE LOOP

HOTEL

Majestic

QUINCY AT STATE STREET

Accommodations of exceptional value

ROOMS WITH PRIVATE BATH FROM $2.

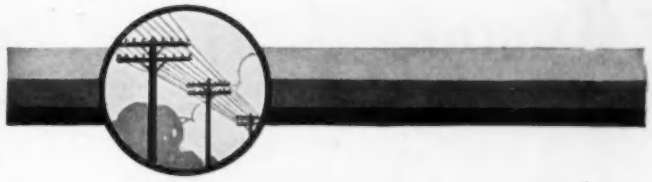
Beautiful meeting room for 300 people

NEW GARAGE NEXT DOOR

HARRY F. HERMANSEN
Manager

JUST AROUND THE CORNER FROM EVERYTHING

in... Chicago



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FOR any type of wire or cable used in Telephone, Telegraph or Power work—get in touch with "Phillips".

This company can supply you with any size, any grade or any type of wire or cable, either bare or insulated to suit your requirements.

Deliveries from this company are unusually prompt, due to the large stocks which are maintained at each of our branches, and their location at strategic points for quick shipment to any place in Canada.

Besides this you have the cooperation of a staff of experts in wire and cable manufacture, trained to value quality above all else—backed by a firm which has been in this one business for over forty years. Write for prices.

We are manufacturers of—

Bare and Insulated Copper Wires—Rubber Insulated Wires—Enameled Wire—Magnet Wire—Power Cables—Switchboard Cables—Paper Insulated Cables—Flexible Cords—Electrolytic Copper Rods, Shapes, etc.

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FACTORIES—MONTREAL AND BROCKVILLE
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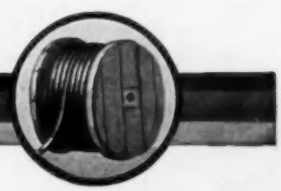


Kearney Corporation Largest of Its Kind

Acquisition of Three Other Companies Including the Chance Company of Centralia, Mo., Makes the James R. Kearney Corporation of St. Louis, Mo., the Largest Manufacturer of a Diversified Line of Overhead and Underground Telephone and Electrical Tools and Equipment in the World

The James R. Kearney corporation of St. Louis, Mo., and the Chance company of Centralia, Mo., are pleased to announce that they have combined the sale of Chance products with that of Kearney products. The uniting of the products of these two companies adds more than $1,000,000 to the capital value of the James R. Kearney corporation and makes their organization the largest manufacturer of a diversified line of overhead and underground tools and equipment for both the telephone and electrical fields.

Left—James R. Kearney
Right—A. Bishop Chance

In addition to the announcement of the Kearney-Chance combination, the James R. Kearney corporation has acquired the sale of the products of the National Duct Rod company, Portland, Ore., manufacturers of duct rods and tree trimmers, and also the sale of strand bands and guy clamps, products of the Morse-Starrett Products company of Oakland, Calif. In addition the Kearney company's Canadian plant is being enlarged.

The Portland company will be moved to St. Louis along with the engineering and sales department of the Morse-Starrett and Chance companies and the advertising department of the latter.

The Chance company, founded by A. Bishop Chance, inventor and manufacturer, hitherto has been the world's largest manufacturer of patent anchors with Kearney ranking second. The amalgamation makes the Kearney corporation by far the largest in the field. Similarly the acquisition of sales rights of the Morse-Starrett company's products makes Kearney the leader in the manufacture of guy wire clamps and guy strand clips.

The Chance company deal involved only the purchase of certain equipment, manufacturing rights, the taking over of the sales and advertising force, and an arrangement whereby equipment will be manufactured for the Kearney corporation in the Chance factory at Centralia without purchase of the $1,000,000 factory building itself, considered one of the model factories of the country.

Mr. Chance will superintend the manufacture of Kearney-Chance equipment in the Centralia factory as well as other items made under designs prepared by Kearney engineers. The deal does not involve the purchase of the Chance piston ring manufacturing business.

The sales rights of the National Duct Rod products was acquired through the negotiations of royalty agreements with the original owners. Similar agreements, plus an unnamed cash consideration, were made in the deal for the Morse-Starrett company.

Inventories are now being made to determine the actual capital value of the acquired concerns. Mr. Kearney said that all three deals were swung without outside financing, and his company will remain free of any indebtedness.

The company's directors beside Mr. Kearney are: Allen B. Williams, E. J. DeRight, W. A. Heinrich and Robert C. Newman. James R. Kearney, Jr., is vice president and secretary.

In discussing the acquisition of the Chance company, Mr. Kearney said:

"It eliminates competition and duplication of sales effort. It gives us more experienced specialists to talk for instead of against Kearney products. It allows us to purchase raw materials in larger volume, therefore at less cost. It gives greater factory production; also gives Kearney corporation another modern up-to-date manufacturing plant.

"It gives the Kearney corporation the most complete line of patent anchors in the world which permits our salesmen to sell the particular type of anchor for any given soil condition. It gives to the utilities the combined experience of Mr. Chance and myself, who for thirty-five years have been familiar with the problems of the electrical and telephone industry; two heads are better than one."

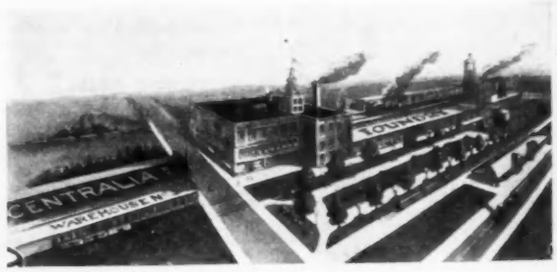
Mr. Kearney said the three new companies would increase his sale volume at least $1,500,000 a year.

The acquisition of sales rights of the three companies is but another chapter in one of the most unusual stories of business expansion ever unfolded.

Mr. Kearney started on a literal "shoestring" in July, 1926. His original factory was one small corner of a large building which his business has long since outgrown. His original force consisted of himself and three assistants. In this small shop Mr. Kearney began the manufacture of several devices of his own invention and some other electrical specialties. The business flourished from the start. Its sales volume for each of

(*Continued on page* 45.)

Plant of the James R. Kearney Corp., in St. Louis, Mo.



Modern new plant of the Chance Company, Centralia, Mo.

DON'T • KILL • YOUR CAR • WITH

RUST

Many a cooling system has been saved from freezing but choked with rust. FLOZON protects your car from freezing, and absolutely prevents RUST. No metal can rust, corrode or gum in the presence of this wonderful year-round cooling-system fluid. Odorless. Non-inflammable. Won't evaporate.

Bond Electric Corp., Jersey City, N. J.

BOND FLOZON

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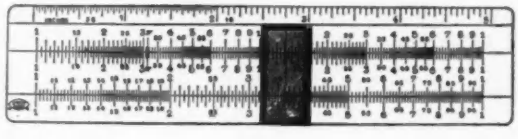
IDEAL · FOR · YOUR TRUCKS · & · SERVICE · CARS

REACH FOR A 'SLIPSTICK' INSTEAD OF A PENCIL

A REAL VEST POCKET SLIDE RULE



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Carry this handy, accurate, easily read slide rule with you—solve your problems in inductance, resistance and capacity—stresses and strains—volume and production costs on the job.

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WHAT'S one more gale *to Copperweld Insulated Drop Wire!*

Where real staying power is needed—resistance to storms, snow, heat, moisture, high winds—Copperweld more than fills the bill.

This twisted pair insulated drop wire is doubly fortified against *all* that the elements can offer.

Stronger than either copper or steel alone, and quality insulated and weatherproofed to Graybar specifications, no wonder Copperweld stands the gaff.

What's one more gale—to Copperweld!

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THE GRAYBAR TAG—SYMBOL OF DISTRIBUTION

Telephone Industry Not Depression Proof

Addresses Given at Twenty-Seventh Convention, Illinois Telephone Association, at Peoria, Tell that Though Telephone Business May Not Decline as Rapidly as Others, It Cannot Pyramid Profits During Prosperity; Also that Though Industry Practices Economy, It Is Not Parsimonious

Peoria, the birthplace of the Illinois Telephone association was also the meeting place for the 27th annual convention of that body held at the Hotel Pere Marquette, November 18 and 19.

Dr. J. G. Schwarz, vice-president of the association, responded to the address of welcome given by H. A. Hartley of the Peoria Chamber of Commerce, by saying that because of Peoria's early connection with the association the city had a sentimental spot in the hearts of all telephone men. He classified success in life as joy in accomplishment and declared conventions are a school for progress.

Dr. Watson Is Convention Guest

A distinguished guest at the convention was Dr. Thomas A. Watson, builder of the world's first telephone. He addressed the convention the afternoon of the second day, as well as the banquet that same evening, and the annual directors' dinner the preceding evening, telling some of the early history of the beginning of the industry, as well as his own experiences after leaving the telephone business.

In his annual address, President R. A. Lumpkin of Mattoon, Ill., said that the general public has the entirely fallacious belief that the telephone industry is "depression proof."

"It may be true that in periods of hard times the telephone business does not decline as rapidly as some other businesses," he declared, "but it is also true that under governmental regulation pyramiding of profits is impossible, even in times of general prosperity.

"To illustrate, I invite a comparison of telephone rates in any community with which you are familiar, to any chart plotting the curve of wholesale commodity prices over the past twenty years.

"Commodity prices attained a peak in 1920 of almost 3¼ times their 1914 level. A sharp decline, however, brought them down to a point about 60 per cent above the pre-war average. For almost ten years they were apparently pegged around this level, yet recent months have brought them back to their approximate 1914 base. This decline has been the cause of the frequent question most of us have recently been asked to answer: 'When are the telephone rates going to come down?'

"While the answer is obvious to all of us, it is not readily recognizable to the average business man. He needs some explanation of the underlying facts."

MacKinnon Gives Statistics

Further interesting facts were given by F. B. MacKinnon of Chicago, president, United States Independent Telephone association, in his address.

Following a brief discussion of the political situation in Washington and what may be expected in the way of bills in Congress this session, he took up the financial aspect of the companies.

"It has been suggested that financial troubles in general are based on too much economy, thus creating troublesome surpluses," he said.

"Economy, according to the dictionary, avoids all waste and extravagance and applies money to the best advantage. Frugality cuts off indulgences and proceeds on a system of saving. Parsimony is frugality carried to an extreme. Economy, therefore, is a virtue; parsimony is a vice.

"Therefore," President MacKinnon continued, "when economy means lack of maintenance of buildings and equipment it becomes parsimony—a vice rather than a virtue."

The telephone industry has always been an economizing industry, according to President MacKinnon, who said there has been little waste; plants have been built carefully and maintained wisely. Companies have been operated on small margins of profit. Wage scales have been lower than in other industries. Management has not had an adequate reward.

"In August, 1930," President MacKinnon said, "telephone companies had 560,500 more telephones in service than in August, 1929. Only 198,500 of these were lost by August, 1931, so that on that date there were 362,000 more telephones in service than in 1929.

"The revenues for the first eight months of 1931, while less than for 1930, were $21,000,000 greater than for the same period of 1929. Operating expenses of 1931 were $13,000,000 greater than for 1929. Maintenance, of which we have been afraid, was $40,000,000 more than 1929, the peak year. Taxes were $6,000,000 more in 1931 than 1929. And the net revenue for these eight months of 1931 was $3,000,000 greater than for the same period of 1929.

"So we are justified in asserting that the reduction in maintenance charges of 1931 were not at the expense of the physical property; the amount expended was the same as for the same period of 1929, the year of greatest expenditures. The total operating expenses were greater and yet the net was greater because the revenues were greater.

"In other words, we of the telephone industry have been practicing economy, the virtue, and not parsimony, the vice."

Commercial Problems

Following President MacKinnon's address, E. R. Cogswell, general commercial manager, state area, Illinois Bell Telephone company, Chicago, spoke of "Some Present-Day Commercial Problems."

The bulk of the commercial job, said Mr. Cogswell, may be summed up in a few words: obtain business, retain it, and collect for it, and at the same time keep everybody satisfied and happy.

New business is divided into three classes, he said, offered business, stimulated business, and employes' sales.

"A few years ago we merely took orders; today we try to sell the subscriber the kind of service he should have," he said.

Another speaker was J. Paul Kuhn, member of the Illinois Commerce commission, Springfield. He stated that the telephone companies are now confronted with a situation which cannot be met by any regulatory commission. They are in a position which they can meet only by the utmost frankness in explaining to the public the usefulness and value of their service, and by exercising a degree of salesmanship they probably never before have found necessary.

Mr. Kuhn suggested that no opportunity be lost to emphasize ways in which telephone service is profitable, by giving absolute facts in an effort to show the farmer, the housewife, the merchant, and others, exactly how he can make money, save money, and sometimes save lives, by using the telephone.

Standard Principles for Poles

A. L. Stadermann, Terre Haute, Ind., chief engineer, Citizens' Independent Telephone company, spoke on "Pole Line Engineering," giving a brief history of poles, and explaining the reason for the standard specifications of poles recently drawn up by the committee of the American Standards association. These specifications were based on the following seven principles laid down by the committee:

Standard fibre stress; measurement six feet from the butt; all poles of the same

length and class have the same strength; all poles of different lengths to be the same class for breaking strength and support the same load; a breaking load of approximately 1,200 pounds; largest class to have a breaking load of 4,500 pounds; and class of poles is arranged in increments.

Mr. Stadermann stated that it is much simpler to design a pole line now than in the past, the principal consideration being given to the strength of poles and the load to be put on them.

An address called "Activities of Your Traffic Department" was presented by Mrs. Mayme Workman, traffic supervisor of the association.

"The Value of Telephone Service to the Farmer," was the subject of a talk by Frank Milhollan, president, Central West Public Service company, Omaha, Neb. Frank F. Fowle, of Chicago, consulting engineer, gave the history and recent accomplishments in meeting the problem of inductive interference in an address called "The Trend of Developments in the Coordination of Power and Telephone Systems."

A. H. Mellinger, of Chicago, operating vice-president, Illinois Bell Telephone company, spoke on "Operating Problems of the Past Year." Another convention guest was R. W. Hedrick, of Jefferson City, Mo., secretary of the Missouri Telephone association, who complimented the Illinois organization on the splendid work of their association, and gave a history of the Missouri Telephone association.

Re-Elect Officers

The convention was exceptionally well attended, having a larger number of delegates than last year's meeting. The same officers were re-elected as follows: R. A. Lumpkin, Mattoon, president; Dr. J. G. Schwartz, Jerseyville, vice-president; A. J. Parsons, Springfield, secretary-treasurer.

The same directors were re-elected with the exception of one new member, H. A. Joslyn, of Sycamore, general manager, DeKalb-Ogle Telephone company, who succeeds W. S. Green, of Pekin.

KEARNEY CORP. LARGEST OF ITS KIND

(*Continued from page 42.*)

the years 1928 and 1929 showed a 150 per cent increase over the previous year and it soon topped the $1,000,000 mark.

During 1930, all its original capitalization, with the exception of common stock, consisting of $100,000 in preferred stock, was liquidated out of cash reserves. The company has never had any bonded debt. Its present capitalization is 15,000 shares of no-par common stock which is held chiefly by Mr. Kearney and his immediate associates.

"UNIQUE"

THE BETTER TORCH
FOR USE
IN COLD WINDY WEATHER

Starts in 3 minutes.
Powerful flame—2000° F.
Fitted with Orifice cleaner.
Tank of 18 gauge steel.
Cool valve wheel—always.
Easily cleaned and serviced.

Try one for 30 days

UNIQUE MFG. CO., INC.
221 Whiting St. Chicago, Ill.

Factories of the James R. Kearney corporation are located in St. Louis, Mo., Centralia, Mo., Taylorville, Ill., and Toronto, Canada.

$2,500,000 CONSTRUCTION PROGRAM

Employment conditions in Southern California were brightened today following the announcement by F. N. Rush, vice-president and general manager of the Southern California Telephone company, that his organization was advancing ahead of normal schedule by 12 to 18 months construction projects involving $2,500,000.

The projects, providing new and replaced facilities, will throw $690,000 in labor channels and will require approximately 59,000-man days of contracted and telephone company labor.

Additional work on long distance routes in Southern California, an east Los Angeles building and equipment, Hollywood equipment and a San Diego garage are among the items which have been named to be under way soon.

The telephone company has kept on the average of 700 persons on the pay rolls through division of labor on reduced time schedules who otherwise would work have been without work owing to the material decrease in volume of business.

Other telephone companies on the Pacific coast are aiding the employment situation by similar construction plans.

TELEPHONE COMPANY INCOME SETS NEW HIGH

Net income of the American Telephone and Telegraph company, world's largest corporation, in the first nine months of this year set a new record high.

Net income for the period was $128,456,315, or $7 a share on the 18,345,713 shares outstanding, against the previous record high of $123,450,182 in the first nine months of last year, or $8.13 a share on the 15,184,389 shares outstanding at that time.

Lenz Electric Manufacturing Co.
ESTABLISHED 1904 Formerly Runzel-Lenz Electric Mfg. Co. CHICAGO
Specializing in Manufacture of
CORDS
FOR ALL CLASSES OF TELEPHONE WORK
SIERRE EQUIPMENT CORPORATION
Los Angeles—San Francisco—Seattle—Pacific Coast Distributors

All-Relay Dial Automatic Exchange Exhibit

North Electric Manufacturing Company Shows All-Relay Dial Exchange at National Telephone Convention, Where It Demonstrates First Complete Step Away from Mechanical Hand and Into the Field of Pure Machinery, Performing with Peculiar Advantages

The "All-Relay Dial Automatic Exchange" which was exhibited at the last national telephone convention and which has been made by the North Electric Manufacturing company in increasing numbers and with constantly widening application in the telephone field for the past 12 years, is an interesting illustration of a certain mode of progress occurring in the development of labor-saving machinery.

It will be noticed that the first forms of such machinery performed by more or less crude mechanical means what the human worker had before performed; these devices were perfected until they did much better and more cheaply what the human worker had done, but still in the same manner. There came a time, however, when invention broke clear away from the methods of the human worker and opened the way to methods and means for performing the needed operations which are not related to the movements of human workers, and present new and unimagined advantages.

A little glancing back over the forms of automatic exchanges which have appeared in the telephone industry in the last 50 years shows in all cases a motor apparatus taking the place of the operator's hand, moving a contact piece corresponding to a plug over a field of terminals corresponding to spring jacks and coming to rest on one of them to make the connection; the mechanical hand replacing the parts at the end of the connection. One of the mechanical hands plugs into the calling line, another seeks out the calling line, by swinging the plug around a circle, or up and around over a bank field, or up a line of terminals; or the mechanical hand slips along over a string of terminals to find an idle trunk. Hundreds of forms of these mechanical hands have been worked out, but invention never got far from the mechanical putting of plugs into jacks. As the principal purpose of the mechanical hand was to get rid of the cost of the human hand, all the limitations in speed, cost, wear, maintenance, and environment, as well as the limitations to the movements the human hand can perform, were accepted as a matter of course.

The North Electric company's "All-Relay Automatic Exchange" exhibits the first complete step away from the mechanical hand and into the field of pure machinery, performing in its own way wtih its own peculiar advantages. It will be hard to find in the "All-Relay" exchange any operation that is performed as an operator performs it. As the name indicates, the parts which shift the circuits about to connect and disconnect lines are nothing but relays; in fact the system is composed of relays, condensers, retardation coils, cables, and frames —nothing else. When a subscriber calls, relays pull up and connect a trunk-link to the calling line; when the subscriber dials the number, relays pull up and take the impulses; other relays pull up in accordance with the dialed number received and connect the link with the called line. In trunking to other groups of subscribers or to other exchanges, relays pull up to pick out the idle trunk. Restoration of the apparatus at the end of connection consists simply of releasing relays. The relays have the simple, solid, durable characteristics which they have attained in a hundred years of perfecting design and use.

There is endless experience to show that the cores, poles, armatures, and coils of well made relays do not deteriorate with age or use. Only armature pivots and contact springs move. The pivots require neither cleaning nor lubricating. The contact springs, when made of proper material and of suitable length, do not change with age or use. Contacts suffer very little deterioration when the volume of current is kept low and sparks are avoided. Certainty of contact is insured in the North relays by the use of double contacts side by side which eliminate failure from dust. The entire relay structure is unaffected by any degree of cold, by any degree of heat up to the point of burning the coils, by any climatic conditions; it requires no lubrication or cleaning. Because of their unchanging character and the ease of foreseeing and measuring exactly the conditions of use which will occur, it is possible to adjust relays in the factory to meet operating conditions with a large factor of safety, and to expect them to operate accurately and without failure throughout a long life, millions of times, without further adjustments.

In the mechanical electors of automatic exchange the complications—as also the uncertainties and changeable factors—are found in the mechanism. In the "All-Relay" switching equipment the simplicities are in the relays, the complications are in the circuits; but as the circuits are wires permanently soldered and bound into cables they require no attention and cause no trouble through an unlimited life.

On these grounds claims are made for the North "All-Relay" exchange that the equipment can be put into operation as sent from the factory, without adjustment in service; that it can last a lifetime unchanged; that it does not require protection from heat, cold, or humidity; that it will operate under wide variations of battery voltage; and that it can be trusted to work for long periods without adjustment or even inspection, the tinker being more to be feared than invited.

It appears that a certain amount of proof of the pudding is forthcoming in the eating. Large numbers of these relays made by the North company for automatic exchanges have been in constant service, at Ashtabula, Ohio, for more than 20 years. Such relays examined in the exchange at Mansfield, Ohio have operated on an average more than three and one-half million times over 10 years without showing appreciable change. Similar relays in seven large exchanges built by the North company, employing about 50,000 relays, show, during a period of observation covering forty million calls, one fault per thousand relays, and one failure in 6,300,000 relay operations. Amongst the 600 relay-selection equipments there are numerous instances in which the exchanges have remained closed and sealed in unfailing operation for many months without attention.

PIPE LINE COMPANY INSTALLS OWN TELEPHONE LINES

The Great Lakes Pipe Line company of Kansas City, Kans., has just completed construction of a large system of gasoline pipe lines from Oklahoma to Chicago, St. Paul, Omaha, and various other centers.

In conjunction with the pipe lines, the company has built its own telephone lines, which include special railway telephone circuits, teletypewriters, duplex telegraph systems, power panels, motor-generator sets, and other special telephone equipment. These telephone lines cross the Mississippi river in a submarine cable north of Davenport, Iowa.

O. B. Fensholt has recently returned to Chicago after spending two months supervising the installation of the telephone equipment in Iowa and Illinois. The outside construction work was done by the Berger Construction company.

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450 ROOMS 300 BATHS

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A Great Hotel in a Great City...Every modern convenience...Special floor for Ladies...Large parlor floor and Ladies' Lounge...New "Dungeon" Dining Room... Also Coffee Shop...Large and small Banquet rooms and beautiful new Ball Room for meetings

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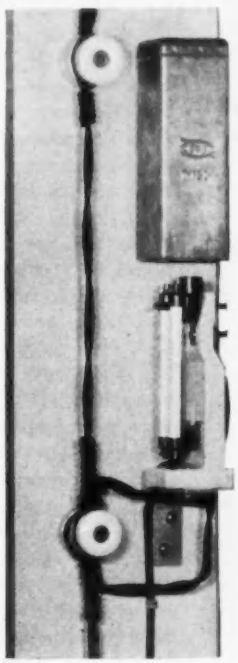

STATION PROTECTOR

TYPE O-7

Mounted outdoors it keeps high potential out of subscriber's premises.

Adequate protection at low first cost and low maintenance cost.

Always accessible when mounted outdoors.

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Everything a telephone company could use—telephones, both automatic and manual, automatic and manual switchboard equipment, construction materials, wires, batteries, supplies—are kept in stock by us. We are prepared to fill every requirement—promptly—with well-known products, noted for their unvarying standards of high quality.

Besides this, we have our own manufacturing and repair facilities—each department manned by experts highly skilled and experienced in their particular specialty. No matter whether you anticipate the modernization of a small rural exchange or the installation of a complete metropolitan telephone system, we are prepared to handle the undertaking in its entirety. Secure prices and proposals from us before making your next purchase—they will be gladly furnished upon request.

Independent Sales and Engineering Company, Limited

VANCOUVER, B. C.

Representatives in Canada for

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THE NEW ANTWERP TELEPHONE AND ELECTRICAL WORKS, Antwerp
AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Liverpool
AUTOMATIC ELECTRIC SALES COMPANY, LIMITED, Chicago
ALTON BATTERY COMPANY, Alton, Eng.

With Manufacturers and Jobbers

STURGIS INTRODUCES NEW OPERATOR'S CHAIR

A new Sturgis Telephone Operator's chair has recently been introduced by the Sturgis Posture Chair company, the distinctive feature of which is a saddle shaped plywood birch seat which is perforated to provide proper airiation.

It is believed by the Sturgis company

New operator's chair placed on market by the Sturgis Posture Chair Company

that this type of seat has an advantage over the cane set in that cane seats very easily become sagged out of shape and consequently uncomfortable.

Another feature of the new chair is the back upholstered in genuine leather over curled hair, which may be adjusted vertically without the use of tools. This chair can be adjusted to any size individual in 30 seconds.

Believing a circular footrest tends to encourage the operator to have her toes point outward, consequently making it hard to keep the knees together and assume a correct posture position, this chair is equipped with straight sections which encourage the feet to point straight ahead, thus making it easier to have the knees together and secure the benefits of a correct sitting position.

The chair is equipped with revolving nickel plated steel glides ordinarily, but can be had with casters if desired.

NEW RELIABLE WEATHER-PROOF PROTECTOR

Where to mount the telephone protector has always been a problem where no basement is available. Some have used the conventional telephone protector mounted in a steel box outside of the building. Some have used protectors designed originally for mounting on the outside of the building but one which has parts that are not interchangeable with the conventional indoor protector.

The Reliable Electric company has now made available a protector for mounting out-of-doors with all of the essential parts interchangeable with one of their standard indoor protectors. This new weatherproof telephone protector is called the Type No. 1000. It embodies several distinct changes and improvements in this line.

The cover is a sliding type of heavy zinc and is grooved to ride on the porcelain shaft so that contact with the line end fuse clips is impossible during removal. This is a very important feature where there is danger of power crosses. The cover is secured to the protector mounting by means of a screw catch.

The bracket is made of heavy iron and thoroughly galvanized to withstand severe weather conditions. This bracket has a slot in the raised position on which a tie knob can be mounted and eliminates the work of driving a third hole on stone, brick or stucco buildings.

The fuse mounting is a distinct step away from the usual practice in that a fuse is mounted on each side of the upright section of the porcelain. This gives ample space in the protector for installing more than one pair of drops. Where party telephones are close to one another they can all be wired to the same protector. In many cases this will cut down the station costs considerably. The hole in the base of the porcelain for the instrument wires can accommodate as many as four party drops by simply punching out the wax filling in the opening provided.

A special low absorption porcelain is used to improve insulation resistance in damp weather. All binding posts are treated to prevent season cracking and are spun over to retain nuts and washers. P-495 Self-Cleaning Sawtooth Discharge Blocks standard equipment.

Descriptive circulars on the No. 1000 Protector are obtainable upon request.

KESTER WINS PATENT SUIT IN DISTRICT COURT

Kester Solder company announces the success of its suit concerning the patent on Kester Plastic Rosin-Core solder. It was recently necessary for the Kester Solder company to institute infringement litigation in the United States District Court for Southern District of New York, against Silva Wares company, Inc., and the New York Solder company, Inc., for infringement of the Ripley Patent No. 1,724,680 covering Kester Plastic Rosin-Core solder.

This patent, but one of a number of patents and application for patent, owned by the Kester Solder company has been adjudicated in the United States District Court for the Southern District of New York. His Honor, Robert P. Patterson, United States District Judge, on August 13, 1931, handed down an opinion holding the Kester Patent valid and infringed by the Plastic Rosin-Core solder which the above mentioned companies had been selling up to the time of the trial which occurred in June of this year. The decree based upon this opinion was entered in the District Court by Judge Patterson on October 30, 1931.

STROMBERG SUPER-SERVICE FOR WAYNESBORO, PA.

Executives of the United Telephone company of Pennsylvania announce the purchase of a nine-position Stromberg-Carlson Super-Service switchboard for its Waynesboro exchange. The board will be equipped with 1,000 lines.

In this switchboard the United company will have the last word in telephone equipment, as it has every feature insuring both operating speed and accuracy.

The new board will have all the features of the Super-Service switchboard, including operator's cut-in, operator's bar, advance plugging-in, operator's listening indication, audible busy test, operator's ringing control, machine ringing, ringing tone, instantaneous ringing cut-off, calling subscribers' ringing control, reverting call ringing, dark keyboard, positive supervision, flash recall, call registration and emergency ringing.

MAIL INFORMATION TO POLE BUYERS

The National Lumber & Creosoting company, Texarkana, Ark-Tex., is distributing three mailing pieces to engineers and purchasing officials of telephone and utility companies, for their information in the buying of poles.

The first mailing piece, recently mailed, gives a graphic comparison of the existing specifications against the specifications proposed by the American Standards association.

The second piece, which will be forwarded soon, contains information relative to the basis on which the new specifications were prepared, while the third piece, to be released soon after the first of January, contains copy of complete specifications for Southern Yellow Pine poles as prepared and approved by the American Standards association.

These mailing pieces should prove of real value to every engineer and purchasing official whose duties embrace design and purchase of materials for pole lines.

WOODWARD WINS CHANCE CO. GOLF TOURNAMENT

H. M. Woodward of Southern Bell Telephone & Telegraph company, defeated R. M. Clayton of the Bell Telephone company of Pennsylvania in the final match of the Chance company golf tournament, November 20. The match was played on the East Lake course, At-

H. M. Woodward

lanta, Ga., the course on which Bobby Jones started his career.

The Chance company golf tournament began early in March and the semi-finals

R. M. Clayton

closed September 20. Scores were turned in from all parts of the United States. Each score was attested by a pro. More than five hundred golfers took part in this contest. The results of the tournament were as follows: D Division, first, R. M. Clayton, Philadelphia, Pa.; second, W. K. Grove, Kansas City, Mo.; third, G. W. Hagen, Covington, Ky. C Division, first, H. M. Woodward, Birmingham, Ala.; second, R. E. Ellsworth, Lincoln, Nebr.; third, J. M. Gillham, Portland, Ore.

The winner of the first prize of each division received a set of six Kroydon Shock Proof irons; the seconds received two wooden clubs of any make and model desired; the thirds, two dozen Silver King golf balls each; and fifty runner-ups received a leather bridge card box. The first winners of the two divisions played a final match for a large 29½-inch golf trophy.

TELEPHONE COMPANY STARTS NEW SERVICE

A new communication service has been made available by the American Telephone & Telegraph company and its associated companies in the Bell system. This new service consists in the establishment and operation of central switching exchanges for teletypewriters, machines that typewrite electrically over wires to a distant teletypewriter. Any subscriber to this service can obtain connection with the teletypewriter of any subscriber to the service within the same city or in a distant city, and this will permit the immediate transmission of letters, typewritten statements or other information between the two subscribers. In effect, the method used for interconnection of the instruments is the same as that now employed in the telephone system.

The present teletypewriter service of the Bell System is furnished only in connection with private wires which are not connected to central switching points. This wire service now widely used for interoffice communication, will be continued as heretofore. The new switching service to teletypewriter exchanges is now possible because of developments in apparatus and operations. These permit inter-communication by teletypewriter on a nation wide basis just as the development of telephone switchboards made possible the inter-connection of telephone instruments.

Soon after the American Telephone and Telegraph company was organized to develop long distance service, it became apparent that the telephone wire system could be adapted to provide circuits to concerns needing private wire facilities.

The private wire service grew rapidly among those needing constant communication with distant branches or correspondents, such as banks, brokers or press associations.

The scope of the service was immediately widened when the teletypewriter began to be used in 1915.

WINTER ECONOMY

IT isn't the Battery that makes Battery maintenance expensive. It's the service. The service costs the same for short-lived Batteries as for Storm King Duro Powr. Duro Powr means what it says: more *effective* power and more hours of usefulness, both obtained by calculation and invention.

Duro Powr is the only big Battery with a seamless zinc cup—the only Battery with an airtight top seal—the only Battery that doesn't let moisture in and energy out through soldered joints or defective tops. Add the D-W patented paper-thin insulator and the extra quantity of mix and you have a Battery that you can depend upon for the longest effective life per installation trip.

GENERAL DRY BATTERIES
INCORPORATED
CLEVELAND, O.

Makers of all types of dependable Dry Batteries for Radio, Ignition, Flashlight and General Use.

FWD FACTORY ADDS NIGHT SHIFT

The Four Wheel Drive Auto company of Clintonville, Wisc., has recently added another shift to take care of the increased demand for FWD trucks. Officials of the company state that never before in the commercial history of the FWD organization have more undelivered orders been on the production schedule.

Starting early in August there has been a gradual increase in the demand for FWD products from state, county, and municipal governments, commercial haulers and contractors. The majority of trucks for highway departments include specifications for the adapting of snow removal equipment, such as dual-motored units, high mounting of headlights and heater-equipped cabs.

When the extra shift was announced, the employment agents secured a full crew within twenty-four hours and in the past four days have had to turn away over four hundred applicants seeking work.

IOWA EXCHANGE TO GET STROMBERG BOARD

The Western Telephone Corporation of Iowa has just purchased five sections of the Stromberg-Carlson No. 13 unit type switchboard for its Ida Grove, Iowa, exchange. It will be equipped with 600 common battery, 40 rural and 20 toll lines. It also will be complete with power, terminal and machine equipment.

The equipment will be installed in a fine new building being erected by the Western Telephone corporation. Its installation will inaugurate a cutover from magneto to common battery method of operation.

FOR SALE

Kellogg late type desk stands, local or common battery, as good as new....$5.00
Kellogg No. 75 common battery steel signalling sets 2.00
Kellogg late type 3-bar 1000 magneto signalling sets 5.00
Kellogg late type 5-bar 1600 magneto signalling sets 6.00
Kellogg transmitter arms with backs, 4-inch ..... .40
Short type wall compacts, new cabinet, Kellogg equipment, 3-bar 1000 $8.00, 5-bar 1600 ..... 10.00

THE TELEPHONE REPAIR SHOP
1760 Lunt Ave. Chicago, Ill.

POSITION WANTED — Married, age 36, experienced telephone man, ten years as line foreman and wire chief; excellent references. Address O. H. F., care Telephone Engineer, 185 N. Wabash Ave., Chicago, Ill.

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Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies
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RECONSTRUCTED EQUIPMENT

Western Elec. No. 315 Inside connection desk set signal set with 3-bar Gen., 1000-1600 or 2500 ohm ringers @ .....$ 5.00
Western Elec. No. 317 inside connection 3-bar Bdg. compact type wall sets. Cabinet size 20½x7¾ inches, equipped with No. 22 Generator, No. 38 1000 ohm 3-inch gong ringer, No. 122 Rec., No. 250 Trans., No. 13 Ind. Coil, etc. @ $6.60 ea., lots 10 @ 6.30
W. E. No. 317 compacts same type as above, but with 4-bar Generator of well known mfg. and 1600 or 2500 ohm ringer @ $8.00, lots 10 @ $7.75 ea.—5-bar @ $8.75 ea., lots 10 @.. 8.50
Western Elec. No. 317 inside connection 3-bar Bdg. compact type wall sets. Cabinet size 18½x7¾ inches, equipped with No. 22 Gen., No. 38 1000 ohm 3-inch gong ringer, No. 143 Rec., No. 350 Trans., No. 13 Ind. Coil, etc., @..... 7.00
W. E. No. 317 compacts, same type as above, but with 4-bar Gen. of well known Mfg. and 1600 or 2500 ohm ringer @ $8.50 ea.—5-bar @... 9.00

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Magneto Equipment

W-E Compacts, 1000 ohm 3-4-Bar, ...$5.00 Each
Kellogg Compacts, 1000 ohm, 3-4-Bar .....$5.00 Each
Monarch Compacts, same as above, ... $4.00 Each
Stromberg Compacts, same as above, ... $5.00 Each
Parts for all makes **Cheap**
Generators, 30c; Cranks, 5c; Induction Coils, 10c; Harmonic Ringers, 25c; Direct Ringers, 30c; Gongs, 2c; Receiver Hooks, 25c; Receivers, 50c; 1 MF Condensers, 15c; Transmitters, 50c.
Transmitter Brackets, 10c.
1 No. 74 Leich Converter, for harmonic (4-party) ringing, almost new..$35.00
10 to 250 Volt Jewel Voltmeter..$5.00

Western Telephone Repair Co., 1016 Yale Ave., St. Louis, Mo.

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WHY BECAUSE it is all up-to-date in design—of the best and most reputable manufacture—and is in most cases generally better than the majority of equipment you now have in service.

Our Stock Is Immense—Magneto or Common Battery—including Switchboards—Switchboard Apparatus—Telephones—Protection Equipment — Cable —everything you need for the installation of a new exchange or maintaining your present one.

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Specializing in Telephone Accounting and Rate Cases Since 1918.
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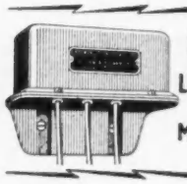

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Western Electric Co. 1020-AL stands with No. 315 type bell boxes, refinished ..**$10.00**

Kellogg No. 118 stands with No. 2328 type bell boxes, refinished **10.00**

Kellogg F-609 bracket telephone, 3-bar 1000 ohm, refinished **11.00**

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The ONE Furnace
for the
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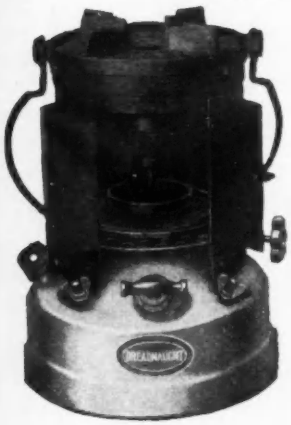

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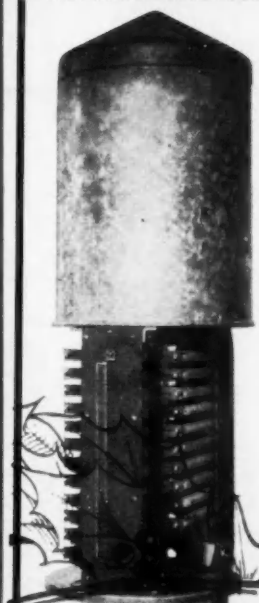
WALL "BIG BRUTE"
DREADNAUGHT Splicers' Furnace



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No. 35

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PROTECTED
TERMINAL
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Made in 11-16 and 26 Pair Sizes

Sands Electric Co.
NORTH CHICAGO
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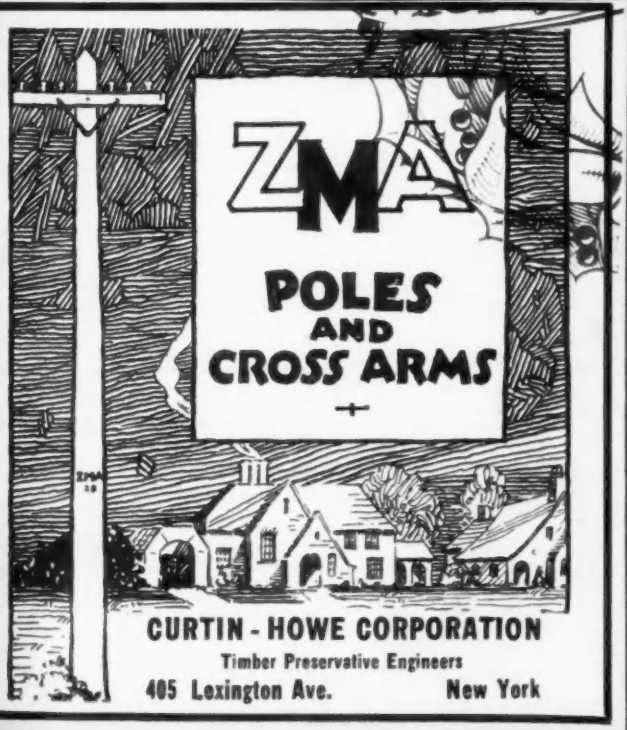

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Timber Preservative Engineers
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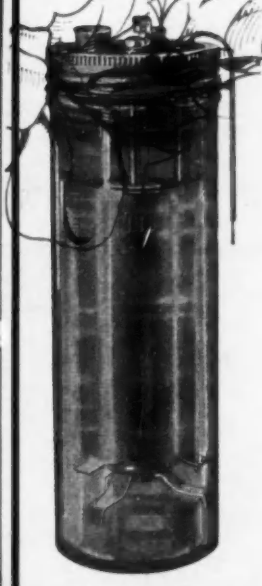

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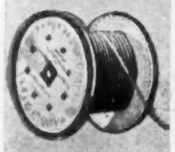
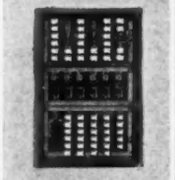
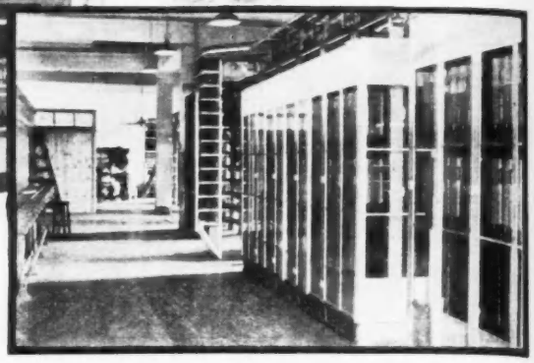
WATERBURY
TELECELL
the long life
TELEPHONE BATTERY

The Waterbury Battery Co.
Waterbury, Conn.







NANKING, CHINA

Above: View of North Office Building at Nanking. At right: General View of Strowger Automatic Equipment at Central Office, Nanking. Strowger Automatic Equipment as Made in the Strowger Factories at Chicago and Liverpool Is Used in Many Other Large Cities in China.

Nanking's New Telephone System is Strowger Equipped

THE progressive spirit of modern China is nowhere better illustrated than in Nanking's new automatic telephone system. In this important city, three Strowger Automatic Dial offices (Central Hsiakwan and North) have been installed and are now in operation, providing the finest modern service to approximately 10,000 telephone users. Other cities in China using the Strowger Automatic system include Shanghai (Native City), Foo Chow, Foo Shun, Chang Zu, Dairen and Harbin—as well as Hongkong, Tientsin and Hankow.

In supplying Strowger Automatic equipment to telephone administrations in every part of the world, this organization has built up widespread sales and service facilities. It brings to bear on every telephonic problem submitted to it the benefit of direct contact with the foremost telephone engineering staff in the world. Not only for dial systems, but also for every phase of both inside and outside plant activity, its advice is up-to-date and dependable to the highest degree, while the products it distributes are of the finest in both design and quality. Prices and tenders gladly submitted upon request.

SUPPLIERS OF THE FOLLOWING PRODUCTS

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STROWGER AUTOMATIC TELEPHONE SYSTEMS

MANUAL TELEPHONE EQUIPMENT

ALTON STORAGE BATTERIES

PHILLIPS WIRES AND CABLES

ELECTRICAL MEASURING INSTRUMENTS

DRY BATTERIES

POLES

and other high quality products in the signal and communication field.

THE AUTOMATIC ELECTRIC COMPANY, LIMITED

Distributors of
Automatic and Manual Telephone Systems—Private Telephone Systems—Telephones
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ANTWERP, BELGIUM

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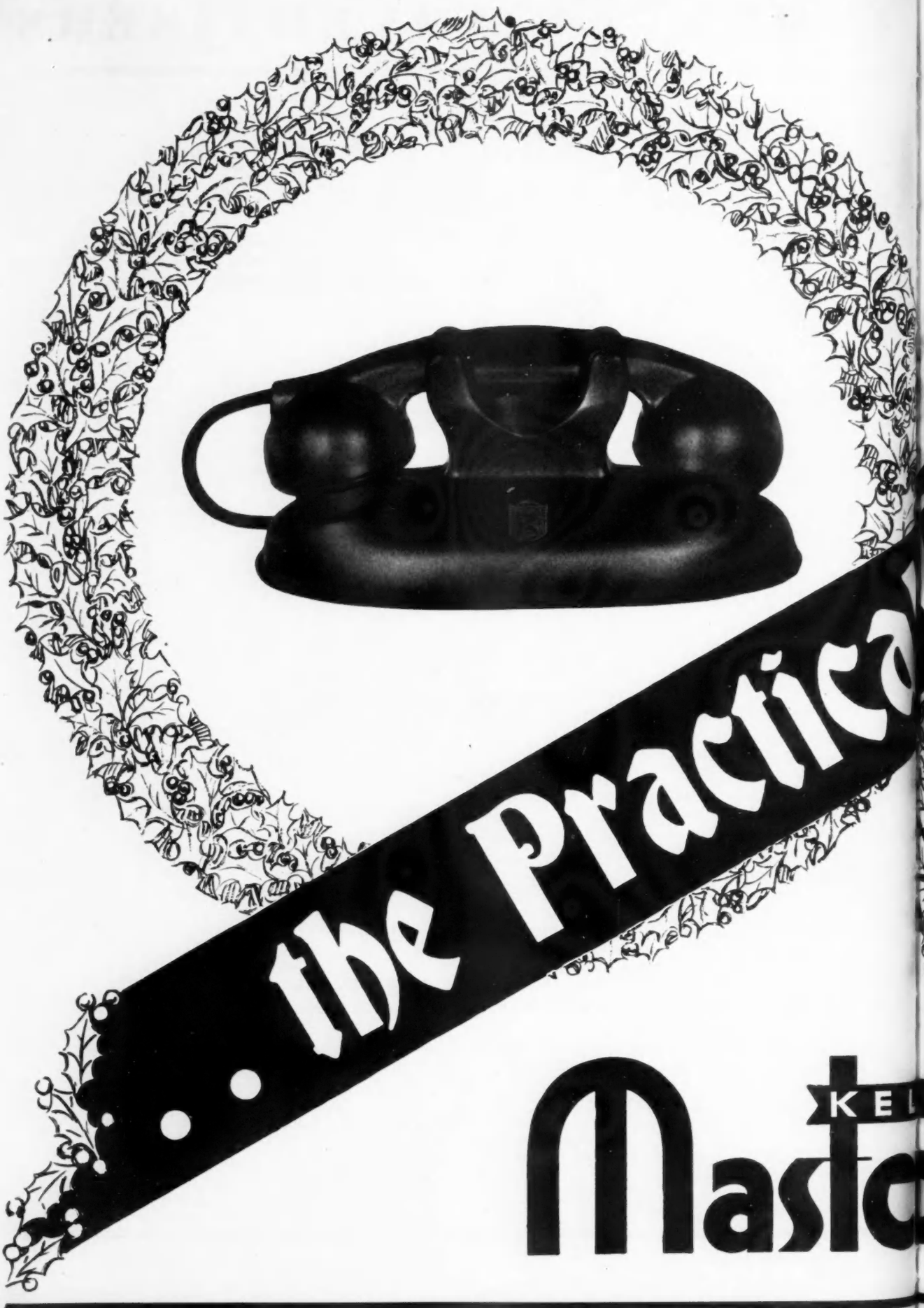
TELEPHONE ENGINEER, December, 1931. Volume 35. No. 12. Published monthly by TELEPHONE ENGINEER. Publication office, 185 N. Wabash Ave., Chicago, Ill. Subscription price, $2 a year in the U. S. Entered as second-class matter June 6, 1922, at the Post Office at Chicago, Ill., under act of March 3, 1879.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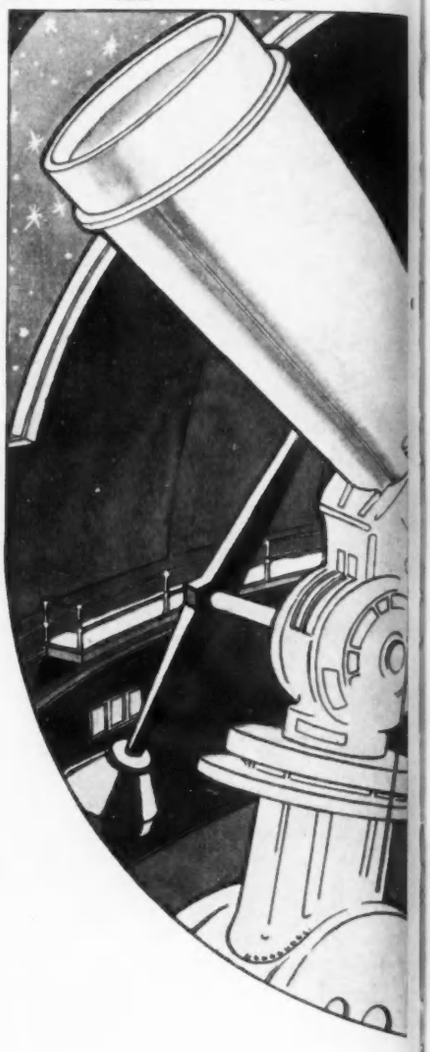

The telescope employed by the astronomer for his observations is big enough to give him an adequate view of the remote planets, yet its control is simplicity itself.

The same condition prevails with the Stromberg-Carlson Super-Service Switchboard. It is large enough to handle the rush of telephone calls during the peak hours and yet it is so simple in its operation that the operator works with practically no fatigue.

This is largely due to the simplified keyboard which is part of the Stromberg-Carlson Super-Service Switchboard. Instead of a great number of keys, there are but four or five keys common to all ringing frequencies. As a result, the operator can use the touch system. It is not necessary to associate the correct cord and key, consequently she gives fewer wrong numbers, puts through calls more quickly, and works at top efficiency during her entire shift.

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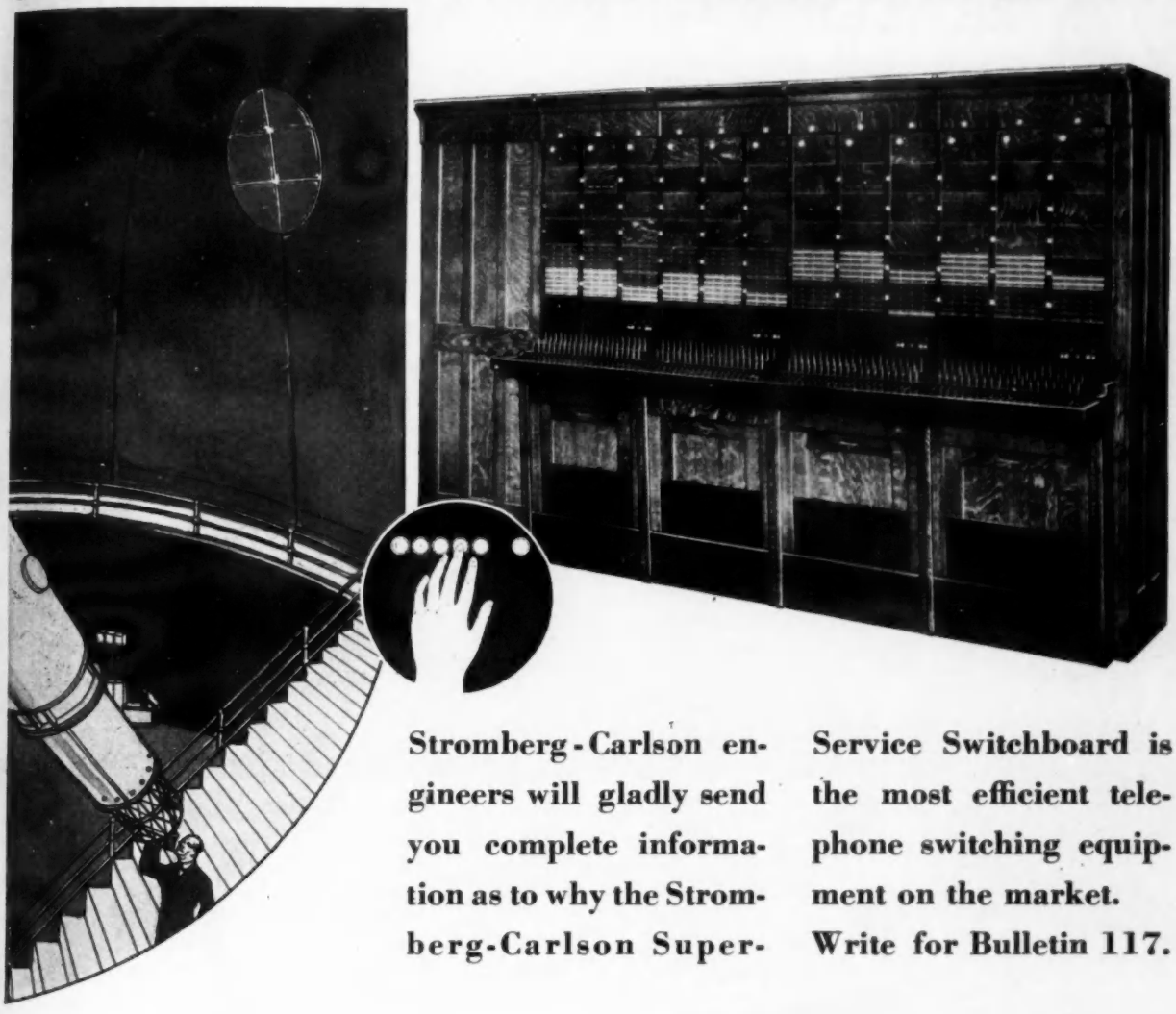

Stromberg-Carlson engineers will gladly send you complete information as to why the Stromberg-Carlson Super-Service Switchboard is the most efficient telephone switching equipment on the market. Write for Bulletin 117.

"There is Nothing Finer Than a Stromberg-Carlson"

—Carlson

7 REASONS for REPLACING YOUR MAGNETO EQUIPMENT.....

with a

Monotype Community Central Battery Switchboard

1. It has a remarkably low initial cost. This means a smaller investment—more easily retired by the savings in operation and the increased earnings.
2. It furnishes swift, accurate common battery service vastly superior to even the best local battery service. Positive supervision makes monitoring unnecessary.
3. It has an operating expense no greater than that of your present switchboard. Your operators can handle more traffic in less time.
4. It is so simple in design and construction that it requires only ordinary, inexpensive help to maintain it. No complicated "features" to worry about.
5. It is so compact that it can be placed in the same location now occupied by the magneto equipment. A large office with high rent is not needed.
6. It is exceptionally easy and simple to install. Anyone familiar with magneto apparatus can do it. There is no equipment "buried" in the switchboard cabinet.
7. It assures you of adequate income because of the superior service it furnishes. It gives better telephone value per dollar of cost than any other switchboard ever built.

Why not get the actual figures on a Monotype Community switchboard for your exchange? There is no obligation. For preliminary information, ask for Bulletin 104.

American Electric Company, Inc.

Factory and General Offices: 6126 So. La Salle Street, Chicago, Illinois

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Cuts order transmission time from 2 hours to 20 minutes!

This experience of the Chain Belt Company may help you to sell Teletypewriter Service to your own subscribers

Formerly the Chain Belt Company, makers of contractors' machinery, used automobiles to carry shipping orders from their Milwaukee office to a distant factory. Often it took as long as 2 hours to write up an order and get it to the plant, and late orders usually could not be shipped until the following day.

Now, with Teletype, the 5 copies of each order necessary for office and factory are written up and transmitted to the plant in about 20 minutes' time. There the Teletyped orders are taken from the machine and turned directly over to the shipping department.

Says an official of the company: "Teletype enables us to ship 90% of all repair part orders the same day as received. This is very important, as a tie-up while waiting for the arrival of repair parts may cost a contractor as much as $200.00 a day. Our saving in the cost of transmitting orders easily pays the rental of Teletypewriter Service, and our customers are enthusiastic over our prompt handling of their orders."

Isn't it possible that there is, in your city, a manufacturer with a widely-separated office and factory who would welcome a service such as this? Better go carefully through your list of business subscribers and see if you can't discover one or more prospects for Teletype . . . the machine that sends typewriting over telephone wires at a speed of 60 words a minute.

The makers of Teletype are anxious to be of aid to managers of exchanges in selling Teletypewriter Service. Descriptive literature is yours for the asking, and the company's sales engineers will gladly co-operate with you. For further information write the Teletype Corporation, 1400 Wrightwood Avenue, Chicago.

TELETYPE

SUBSIDIARY OF

Western Electric Company

The Monophone exemplifies in both its appearance and performance the age in which we live. In it beauty is combined with convenience, reliable operation with durability, and excellent transmission with long life. Furnished in standard black and other colors.

TELEPHONES MADE OF MODERN MATERIALS

THE graceful, moulded lines and beautiful satin-like finish of the Monophone are apparent at first glance. Yet these modern styled telephones are durable and rugged to a high degree, and give long years of reliable service with a minimum of maintenance expense.

This highly desirable combination of strength with beauty is made possible in the Monophone, as well as in other telephones manufactured by Automatic Electric Inc., by the use of Bakelite. This material is capable of being moulded in artistic and graceful shapes, its lustrous finish lasts throughout the life of the instrument, it is highly dielectric, and it combines light weight with unusual strength.

When you next buy telephones, either for new installations or for replacement purposes, why not try Automatic Electric instruments? Subject them to the most rigorous tests—you will find them superior in every respect.

Catalog and prices on request.

Automatic Electric Inc.

Manufacturers of

STROWGER AUTOMATIC DIAL TELEPHONE AND SIGNALING SYSTEMS

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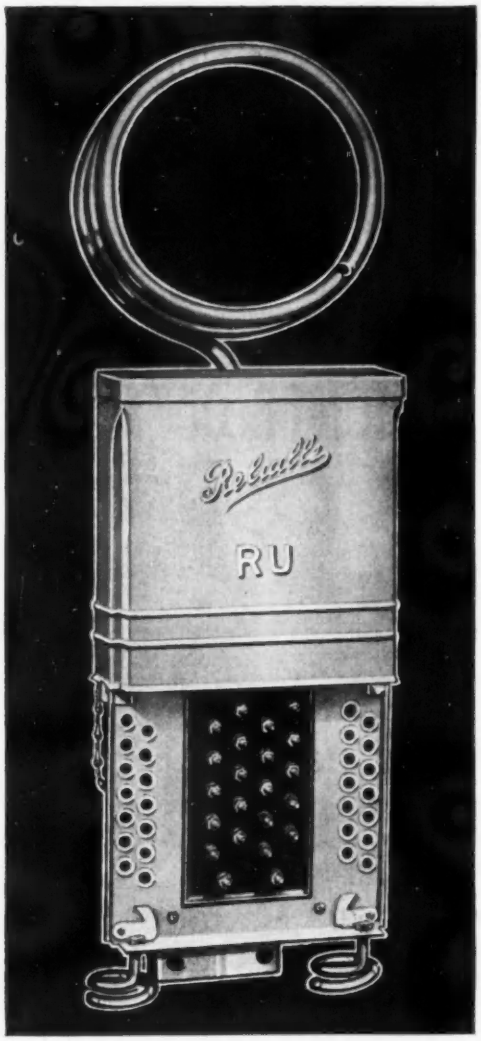
THE NEW "RU" CABLE TERMINAL



WITH

A Detachable Mounting Bracket

A Cast Iron Cable Chamber

A Heavy Zinc Sliding Cover

A Flat Unobstructing Fanning Plate

A High Grade Bakelite Face Plate

A Reversible Feature

THE RELIABLE "RU" CABLE TERMINAL WAS DESIGNED TO SIMPLIFY INSTALLATION, TO OUTLAST THE CABLE, TO IMPROVE ON WEATHERPROOFING, TO SIMPLIFY DROP WIRING AND TO PRODUCE A TERMINAL IN KEEPING WITH THE PROGRESS OF THE TELEPHONE FIELD.

WRITE FOR FURTHER INFORMATION OR SAMPLES

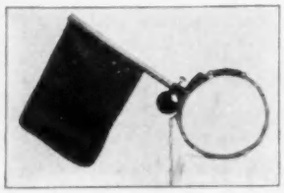
Reliable Electric Company

3145 CARROLL AVE. CHICAGO, ILLINOIS

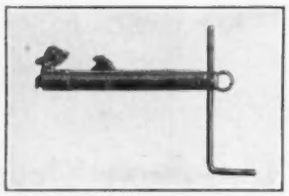
COFFING HOISTS

"THE UNIVERSAL TOOLS"

are being used by Telephone and Power and Light Companies in construction and maintenance work, changing insulators on tower lines, for pulling guys, messengers, underground cables, laying water and gas mains, or wherever a lift or pull is needed. Can be used in any position. Sizes from ¾ to 6 ton, wt. from 14 to 65 lbs. Model A ¾ ton. Model F 1½ ton.

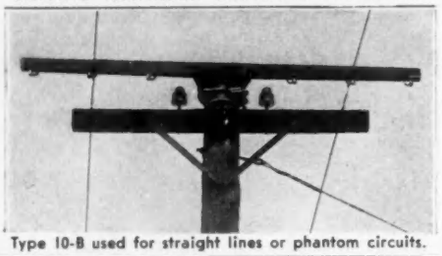


Flag, flag holders, and electric light for poles, pipes, etc., in transit day or night. Can be easily attached or removed. Spring attached to chain so holder will not work loose.



Temporary Guy Clamp. For necking guy wires under heavy tension. 3 bolt clamp can be put in proper location without using hammer.

COFFING TEMPORARY CROSSARM AND CLAMP



Type 10-B used for straight lines or phantom circuits.

They can be readily clamped to a pole above or between the crossarms. For changing crossarms on corners or on pole lines.

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THE SUPER-RINGING MACHINE MEETS ALL THE REQUIREMENTS OF GOOD RINGING SERVICE

More Power

Less Attention

Suitable for the largest Central Office or the smallest P. B. X.

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Price $44.00 F. O. B. ELYRIA, OHIO

Sold by Leading Telephone Distributors

TELKOR, Inc. . . ELYRIA, OHIO

You bury it RIGHT OFF THE REEL!

Economies of tape armored cable start with the laying

Layers of impregnated paper, jute, steel tape and asphalt are placed over the lead sheath.

It is so well protected that you can bury this Western Electric Tape Armored Cable *directly in the ground.* Think of the savings in laying costs. Think how much quicker it is to lay.

Once it is laid it lasts a long time. No less than seven layers of protective coatings guard against corrosion from soil or water.

The name Western Electric tells you that this cable is made by pioneers in the manufacture of communication equipment—pioneers that have continued to keep abreast of the times in making apparatus for the Bell System.

Western Electric

LEAD COVERED CABLE AND TELEPHONE APPARATUS

Distributed by

GRAYBAR ELECTRIC CO.

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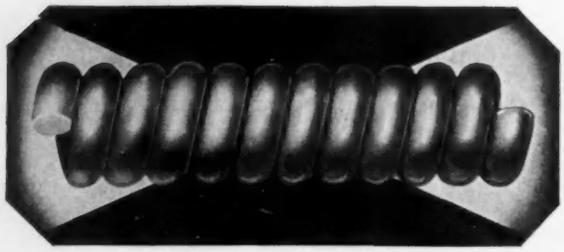

Galvanized Telephone Wire and Steel Strand

Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating....That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

Look for the **Crapo** Seal!

Indiana Steel & Wire Co.
Muncie, Indiana

INDIANA STEEL & WIRE CO. Crapo Galvanized MUNCIE, IND.

Crapo GALVANIZED PRODUCTS

Insure Your Overhead Lines

BY SPECIFYING

MacGillis

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PLAIN or BUTT-TREATED

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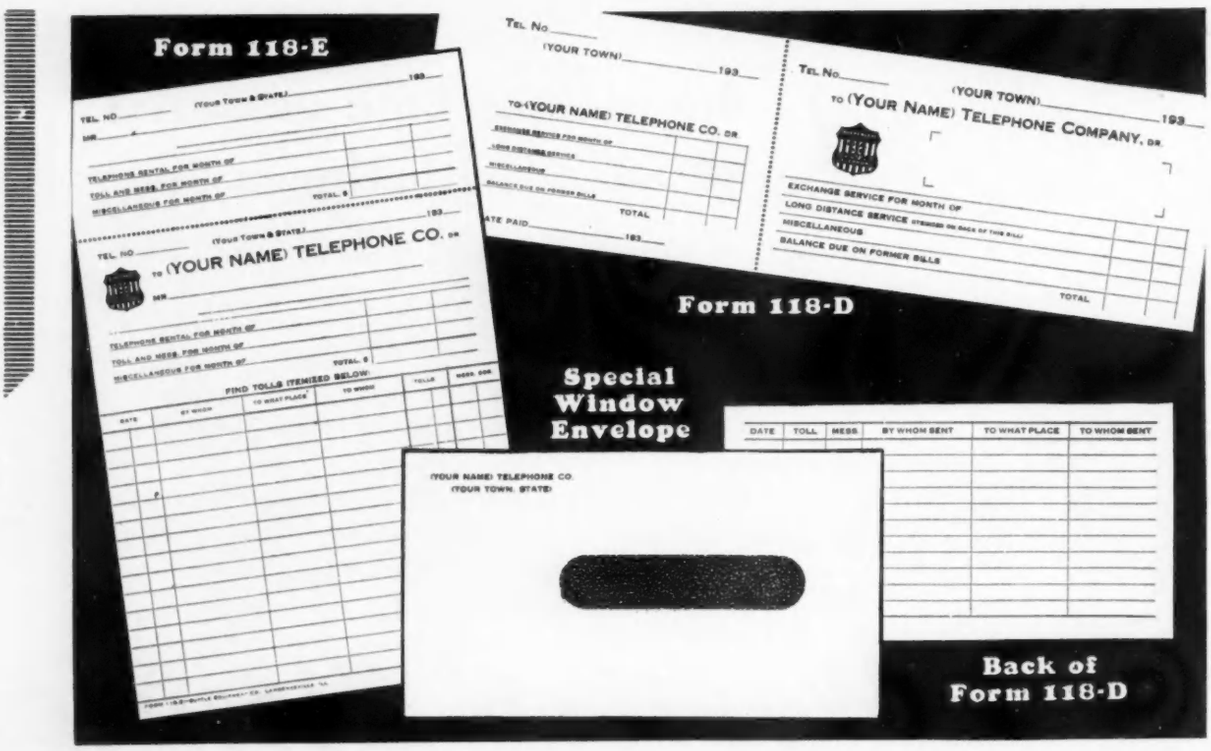

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High Quality Manila—Panel Cut

1,000	$3.00
2,000	per 1,000 2.70
5,000	per 1,000 2.30
10,000	per 1,000 2.20

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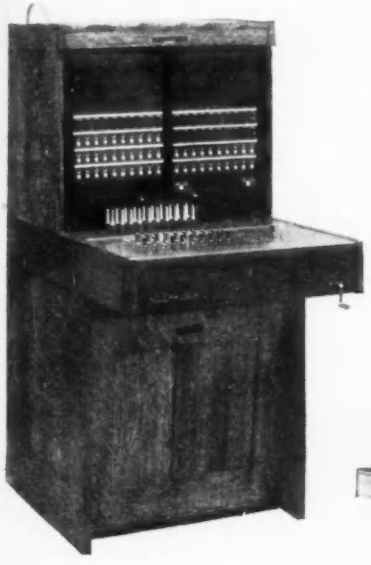
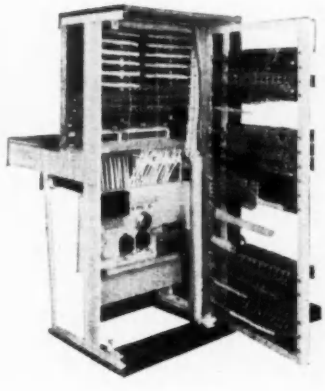
The Modern Signal





"There is Nothing Finer than a Stromberg-Carlson"

Light, the attention-compelling factor in nearly every modern signal, has been adopted because it is the surest means of attracting attention.

In the Stromberg-Carlson Lamp Signal Magneto Switchboard the obstacle that previously made lamp signals for code signalling on long magneto lines impractical has been overcome.

The Long Line Lamp Signal Cut-Out is the answer. During the night or light traffic hours, when the operator is not in constant attendance, the relays operate and code calls on the same line are completed without lighting the lamps.

When a single ring indicates to the operator that her services are required, she disengages the Cut-Out Key and the lamps on all lines that have been used during her absence light. The successive challenging of the indicated lines quickly brings her to the calling party. This feature saves a considerable amount of current and adds materially to the life of the lamps.

Stromberg-Carlson Engineers will gladly point out the service feature and economies that can be realized through the use of the Lamp Signal Magneto Switchboard.

Write for Bulletin No. 118.

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AUTOMATIC
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SIMPLE, SOLID
UNCHANGING, LASTING

LOCK THEM UP
LEAVE THEM ALONE
THEY WILL WORK

INCREDIBLE? IT'S TRUE

NO LIMIT IN SIZE
HUNDREDS IN USE

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